FL1-2 MICROWAVE RADIO

Technical Information

FARINON

1691 BAYPORT AVENUE ▪ SAN CARLOS ▪ CALIFORNIA 94070 ▪ PHONE (415) 592-4120

mini loss PAD = $R1 = \sqrt{Z1(Z1-Z2}$

$$R2 = Z1\,(Z2 \div R1)$$

Loss in db = $20 \text{ Log } \sqrt{Z1 \div Z2} + \sqrt{(Z1 \div Z2)} - 1$

Z1 = 600Ω
Z2 = 75Ω
R1 = 56Ω
R2 = 80Ω
Loss = 14.76db

Pilot −10dbmo O.W. 0dbmo (except when preemphasis)
Forse −13dbmo
Seg −20dbmo
m means no preemphasis
FL12 − m − xxxx

noise produced device NOT noise
NO DAN

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*TI not required

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DESCRIPTION OF FARINON INSTRUCTION MATERIAL, EQUIPMENT SPARES, PARTS ORDERING, AND CUSTOMER SERVICES

CONTENTS

1. GENERAL

1.01 The Farinon Instruction Manual is custom-made for each rack or assembly, based on the equipment supplied as specified on the Wiring List described in Part 2.

1.02 Parts 3 and 4 describe the various publications and drawings included in the instruction material for Farinon multiplex and radio equipment. Parts 5 and 6 tell how to relate the SD- drawing and model numbers to a particular piece of equipment, and Parts 7, 8, 9, and 10 describe sparing philosophy and parts availability. Parts 11 and 12 describe Farinon customer services.

2. WIRING LIST (FWL-XXXXX)

2.01 The wiring list itemizes the equipment shipped from the factory and describes the arrangements and options which form a rack or assembly. The wiring list is included in the instruction manual shipped with each rack or assembly.

2.02 A basic terminal consists of one or more racks or assemblies, which provide radio, multiplex and/or miscellaneous items, according to system requirements. The individual assemblies that comprise a terminal are wired and equipped according to the wiring list assigned to the terminal. Both the rack (or assembly) and the list bear a number-letter code designation usually based on the Farinon Sales Order Number. For example, the designations FWL-12345A and FWL-12345B refer to assemblies at two different locations, both wired and equipped per Farinon Sales Order #12345. If more than one rack is equipped at a particular fixed location, a number suffix is added to the coding, e.g. FWL-12345A1, FWL-12345A2, etc. The FWL number is stencilled on the base plate of the rack mounted assemblies.

2.03 The wiring list is divided into two parts: 1) Equipment Arrangement; and 2) Equipment List.

EQUIPMENT ARRANGEMENT

2.04 This optional section provides a front view drawing of the rack mounted assemblies, multiplex equipment, jackfields, and sometimes miscellaneous equipment.

EQUIPMENT LIST

2.05 This itemizes all panels, units, and other items that comprise a rack or

assembly. It contains the following information.

(a) The serial number and operating frequency of each transmitter and receiver if radio is equipped.

(b) The schematic diagram number (SD-XXXXX) and its issue number for each equipment item, as well as the appropriate figure numbers and options.

(c) The quantity of individual units or panels required for the rack or assembly.

(d) A list of all wiring drawings and Block and Level drawings for the assembly.

3. PUBLICATIONS

GENERAL

3.01 A manual consists of standard and/or non-standard publications. Standard documents will always be included in the manual; non-standard documents may or may not be included in the manual.

STANDARD DOCUMENTS

A. Descriptive Information (DI)

3.02 The DI publications provide an electrical and mechanical description of an assembly or system and usually contain a table of specifications. These publications are given an equipment name and keyed to a BL- (Block and Level) drawing when describing a terminal assembly. They are given a five or six digit number and keyed to an SD- (Schematic Diagram) when describing a shelf assembly or similar assemblies that are part of a terminal assembly. A DI bears the suffix DI in the form designation. For example, "DM11-2A DI" is the named Descriptive Information publication for a complete DM11-2A terminal assembly, and "83015-M2 DI" describes a "numbered" 83015-M2 Auxiliary/Order Wire Shelf.

B. Alignment Procedure (AP)

3.03 The AP publications describe the initial "turn-up" and alignment procedures, as well as routine maintenance checks. These publications bear the suffix AP in the form designation. For example, a "DM11-2A AP" is the alignment procedure for a DM11-2A radio terminal. An AP is usually used with an associated BL- (Block and Level) drawing.

C. Maintenance Procedure (MP)

3.04 The MP publication contains trouble shooting procedures and replacement procedures for a multiplex or radio system. These publications bear the suffix MP in the form designation. For example, a "DM11-2A MP" is the maintenance procedure for a DM11-2A radio terminal. Maintenance procedures presently exist for only a few equipment items.

D. Technical Information (TI)

3.05 Publications which bear the prefix TI- describe the operation of individual panels or units and provide a technical summary. TI- descriptions are keyed to an associated schematic diagram. Technical Information TI-12345, for example, carries the same number as Schematic Diagram SD-12345. In some instances, where a unit SD- diagram is sufficiently simple to be self-explanatory, a TI- will not be provided. A TI- is not written for special equipment which is described in the SED publication.

NON-STANDARD DOCUMENTS

A. Special Equipment Description (SED-)

3.06 The SED- publications explain special equipment supplied for a particular sales order and/or special uses of standard equipment. When necessary, the SED- also contains alignment information and describes the special aspects of the overall

system in general terms. An SED bears the sales order number in its form designation. For example, SED-12345 is a Special Equipment Description for Sales Order #12345.

B. Replacement Procedure (RP)

3.07 The RP publications contain replacement information for a complete assembly or an individual unit. This document is considered non-standard because the information is normally provided in the MP publication. An RP bears the unit number or the assembly designation in its form designation. For example, "DM2-7A RP" is the replacement procedure for the DM2-7A radio assembly.

4. DRAWINGS

GENERAL

4.01 Drawings are part of the instruction manual. Following is a list of Farinon drawings which may be included in the manual.

SPECIFICATION DRAWING (FJ-XXXXX)

4.02 This drawing is of primary interest to the engineer ordering or specifying equipment for a system. It lists all units, panels, and hardware for a specific terminal assembly. The FJ- drawing is a standard drawing in the format generally used by the larger telephone operating companies, who order radio and multiplex assemblies in one of several fixed packages.

BLOCK AND LEVEL DRAWING (BL-XXXXX)

4.03 This drawing shows the transmission path in block schematic form, with levels or signal voltages noted throughout for system alignment and maintenance. Generally it is used in conjunction with the Alignment Procedure (AP). An additional BL- drawing may be supplied which bears the five digit number of the Farinon Sales Order. This drawing covers the entire terminal assembly and refers to the equipment included on the standard BL- drawing by showing a box with the standard BL- number in it.

EQUIPMENT WIRING DRAWING (EW- or FT-XXXXX)

4.04 The EW- drawing shows all interconnecting wiring between panels and units of a rack assembly, including wire size and color; it also shows external office connections to the assembly. The FT- drawing is a standard drawing in the format generally used by the larger telephone companies who order radio and multiplex assemblies in one of several fixed packages.

APPLICATION SCHEMATIC DIAGRAM (ASD-XXXXX)

4.05 This drawing shows certain transmission and power wiring for a complete assembly, with terminal block and pin plug numbering at appropriate points through the transmission path.

FARINON SKETCH (FSK-XXXXX)

4.06 This designates equipment that provides a function not available in the standard product line. The FSK- number will be on the unit or panel, and the interconnect wiring will be shown on the EW- drawing. There may not be an FSK- drawing.

SCHEMATIC DIAGRAM (SD-XXXXX)

4.07 This drawing provides a schematic wiring diagram of individual panels or units. These drawings provide full information on electrical options and component values.

5. EQUIPMENT ISSUE NUMBERS

5.01 Farinon Electric provides constant attention to the improvement of its product line, which necessitates circuit changes from time-to-time on many panels

and units. Whenever a circuit change is made, the Schematic Diagram is revised and reissued under a new issue number. Foilcals, applied to the equipment at the factory, tell which drawing issue was used in its assembly, as shown in Fig. 1.

6. EQUIPMENT MODEL NUMBERS

6.01 Equipment model numbers are indicated by a suffix to the SD- number (SD-XXXXX-M2), SD-XXXXX-M3, etc). An SD- number without a suffix is understood to be Model 1 (-M1). An earlier model cannot replace a later model without the possibility of degrading system performance. For example, if an assembly is originally equipped with an -M2 unit, it can be replaced with an -M2 or later model, but an -M1 unit may degrade system performance.

7. EQUIPMENT SPARES

7.01 At the time an order is made, or upon subsequent request, Farinon will furnish a recommended list of minimum spare units for any system. The high quality performance of Farinon equipment is best maintained by isolating trouble to a specific unit and then replacing it with a spare or factory-repaired item.

7.02 Address all orders and inquiries for replacement units or component parts to:

LETTER: Farinon Electric
ATTEN: Customer Service
1691 Bayport Avenue
San Carlos, CA 94070

TELEPHONE: (415) 592-4120
Ask for Customer Service

TELEX: 34-8491
ATTEN: Customer Service

8. REPAIR AND RETURN

8.01 Farinon offers factory repair service for all of its equipment. In most cases, loaner units are available to customers while their items are being repaired. The Customer Service department can be contacted (paragraph 7.02) for advice on whether field repair, factory repair, or replacement is advisable for a specific unit.

8.02 Farinon Customer Service should also be contacted for instructions before returning equipment to the factory. Equipment under warranty will be repaired at no charge. Repair charges for equipment out-of-warranty are nominal, and estimates are available from Customer Service upon request.

8.03 To ensure prompt service when returning equipment to the Farinon factory, please fill out the Repair Requisition at the end of this publication.

9. COMPONENT PARTS

9.01 Customers wishing to do their own circuit board repair can order component parts by sending Farinon the circuit designation (such as C101 or R16), together with the SD- drawing number and the SD- drawing issue number (number in circular foilcal on unit, as explained in Part 5). Circuit designations are found by relating the component to adjacent lugs and tie-points, which are either number or letter coded on both the circuit board and the drawing. With this information, the component circuit designation can be read from the drawing. Newer units have the component circuit designations printed on the boards.

9.02 Certain parts, such as resistors and capacitors, can often be obtained locally. Replacement semiconductors must be of the same manufacturer and type number as the original.

9.03 Any orders above the component level must be for a complete unit, i.e., a unit marked SD-XXXXX, or for an assembly that includes one or more units (SD's). Subassemblies below the SD- level are not available for sale.

10. PARTS LISTS

10.01 Farinon equipment is designed to be repaired by replacement at the unit level with readily available spares. For this reason, parts lists are not normally furnished with an order, nor are they recommended as a customer requirement. A parts list, however, can be prepared by special order.

11. TECHNICAL SERVICE

11.01 Farinon's Customer Service department provides technical information, troubleshooting assistance, and field repair advice. These services can be obtained by letter, telephone, or telex as described in Part 7.

11.02 After normal working hours, emergency calls will be referred to an on-duty engineer for troubleshooting and field repair assistance.

12. FIELD SERVICE

12.01 On-site field service, if required for assistance in troubleshooting and resolution of system and operational problems, may be arranged by contacting the Customer Service department by one of the means listed in Part 7.

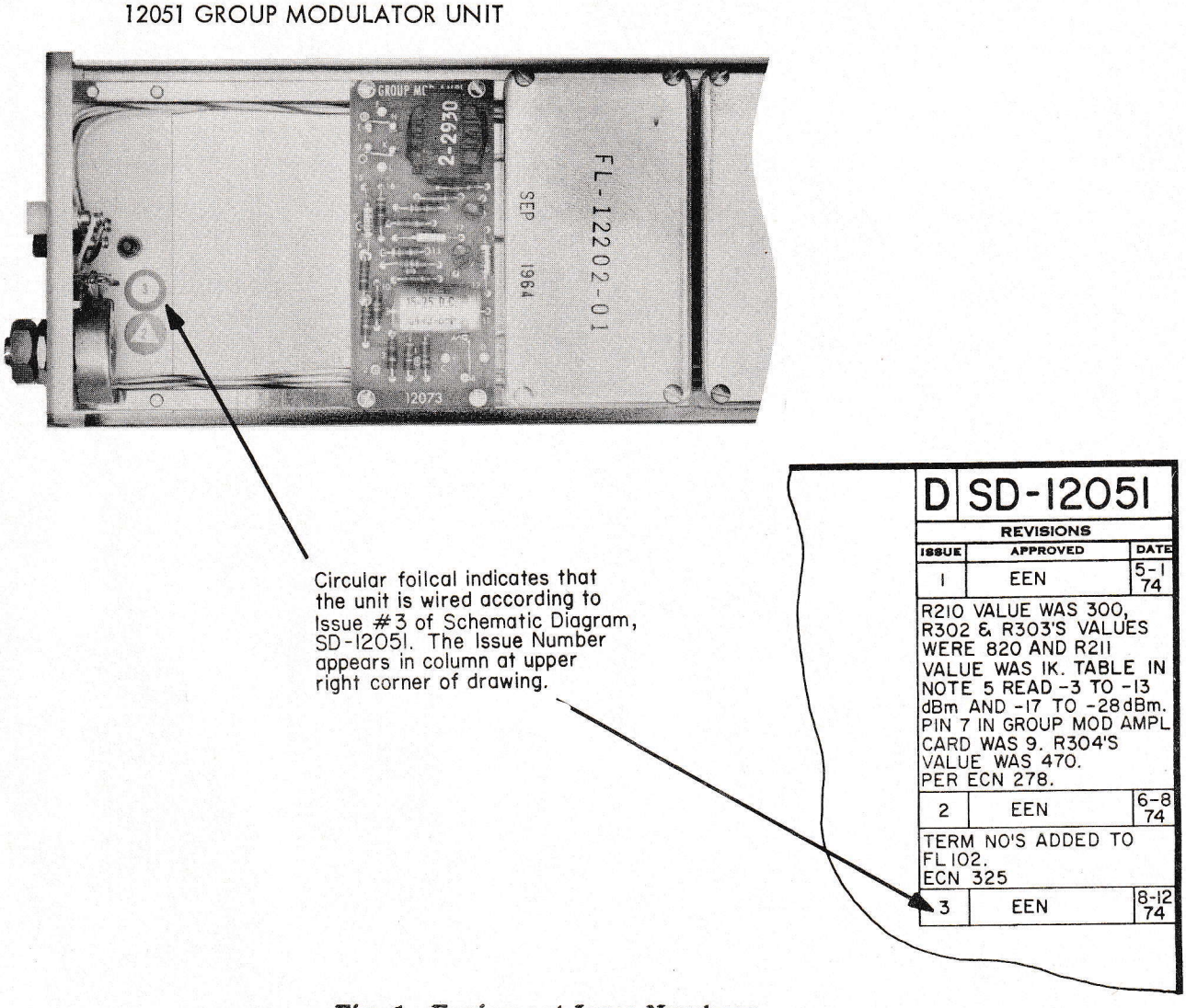

Fig. 1--Equipment Issue Numbers

PLEASE FILL OUT COMPLETELY AND RETURN WITH EQUIPMENT TO BE REPAIRED

REPAIR REQUISITION

CUSTOMER NAME _____

FARINON WIRING LIST NUMBER FWL- _____

☐ IN WARRANTY

☐ OUT OF WARRANTY

☐ UNKNOWN

CUSTOMER PURCHASE ORDER NUMBER _____

CUSTOMER BILLING ADDRESS _____

_____

_____

DATE RETURNED TO FARINON _____

REQUESTED REPAIR TIME:

☐ EMERGENCY (24 HRS): MUST BE PRECEDED BY A TELEPHONE CALL TO FARINON FIELD SERVICE AT (415) 592-4120.

☐ EXPEDITED (2 TO 9 DAY SERVICE): BY SPECIAL ARRANGEMENT. CALL FIELD SERVICE.

☐ NORMAL (30 DAY SERVICE): STANDARD NO PRIOR ARRANGEMENT REQUIRED.

IMPORTANT!! PLEASE DESCRIBE TROUBLE SYMPTOMS.

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IF EQUIPMENT IS RETURNED FROM OUTSIDE THE UNITED STATES, INCLUDE A STATEMENT THAT THE EQUIPMENT WAS MANUFACTURED IN THE UNITED STATES. THIS IS NECESSARY TO EXPEDITE CUSTOMS CLEARANCE.

SHIP TO: FARINON ELECTRIC
ATTEN: FIELD SERVICE
1691 BAYPORT AVENUE
SAN CARLOS, CA 94070

DESCRIPTIVE INFORMATION

FARINON TYPE FL1-2

MICROWAVE RADIO ASSEMBLY

CONTENTS PAGE

1. GENERAL

1.01 An FL1-2 Microwave Radio Assembly provides terminal or repeater equipment for a 1700-2300 MHz microwave system. The system is available in the following configurations: non-protected (NP); monitored hot standby (MHS); or loop protected (LP). The MHS and LP configurations vary from the NP configuration only by the addition of protection equipment and an additional transmitter/receiver. The radios in all configurations are basically the same. Refer to Table A for the specifications.

1.02 An NP terminal assembly consists of a transmitter, an antenna coupling unit, a receiver, an assembly meter, and baseband equipment. The MHS assembly is the same, but adds an extra transmitter, receiver, and protection equipment. The MHS transmitters operate on the same frequency. Repeaters in all configurations consist of two back-to-back terminals. (A loop repeater has the same configuration as an NP repeater.)

1.03 Order wire circuits can be supplied with the radios.

1.04 A radio continuity pilot is injected into the system at the transmitter baseband amplifier via the baseband interface. If the pilot is lost, an alarm will appear at the receiving station.

2. MECHANICAL DESCRIPTION

2.01 The radio assembly consists of RF equipment with baseband conditioning and baseband interfacing circuitry. A separate order wire is optionally available. A complete NP terminal, NP repeater, or MHS terminal occupies twenty 44.5 mm (1-3/4 in) vertical rack-mounting spaces on a standard 483 mm (19 in) rack.

2.02 The RF portion of the NP terminal consists of a transmitter, receiver, and an antenna coupling unit. Each half of the equipment frame houses a complete NP transmitter/receiver assembly with component units stacked vertically. The same equipment frame houses a complete MHS assembly. The RF portion of the MHS assembly is similar to the NP assembly, but has an extra receiver and transmitter, and a diode or coaxial relay RF switch with associated control equipment.

3. ELECTRICAL DESCRIPTION OF TRANSMITTER

BASEBAND EQUIPMENT

3.01 Baseband signals enter the baseband shelf via BNC connectors located on the faceplate of the baseband interface unit. The baseband interface has three baseband inputs plus a pilot input. The baseband and pilot inputs are combined in a resistive network of the transmitter section of the

baseband interface and are forwarded to transmitter baseband amplifier(s) via a BNC jack on the faceplate of the baseband interface.

3.02 In NP and loop protected systems, the output of the interface unit feeds one transmitter baseband amplifier. In MHS assemblies, there are two outputs that feed two transmitter baseband amplifiers. The input to the transmitter baseband amplifiers is via coaxial cable and type BNC connectors. Since these are high impedance inputs, removal of one amplifier does not affect the level into the other amplifier. MHS systems also provide a test input jack on the front panel of the interface unit. A test jack on the interface unit is provided for connection to the input jack of the baseband amplifier. This requires disconnection of the normal link to the baseband amplifier which interrupts the continuity pilot signal and causes a pilot alarm to be sent to that transmitter. To prevent a pilot alarm from terminating the transmitter, it can be locked in-service with the MHS CONT switch.

3.03 The transmitter baseband amplifiers are of fixed gain and provide the amplification necessary to increase the baseband signals to the level required by the transmitter oscillator-modulators (OSC-MOD). An emphasis network is equipped which alters the gain-versus-frequency characteristics of the modulating signal. The pre-emphasis characteristics are shown in a figure in the Technical Information (TI-) publication for the transmitter baseband amplifier. A monitor jack on the faceplate of the transmitter baseband amplifier is equipped to allow the baseband signal to be monitored before pre-emphasis is introduced.

3.04 A continuity pilot signal is generated at the pilot oscillator and monitored locally via the transmitter AFC. The pilot is introduced onto the main transmission path at the baseband interface and is normally transmitted at all times.

3.05 The transmitter alarm unit contains alarm circuitry which receives RF power, pilot, and AFC information from the transmitter AFC unit. This information is continuously monitored; if an abnormal condition occurs, an alarm is keyed on. Alarms operate individual alarm indicator lamps on the face of the transmitter alarm unit and a summed alarm relay which provides dry contacts for an external alarm. In an MHS assembly, the AFC alarm and low RF power alarm are summed and fed (with the pilot alarm) to the MHS control unit.

RF EQUIPMENT

3.06 Baseband modulating signals from the transmitter baseband amplifier are cabled to the transmitter RF assembly where they are fed directly to the input of the OSC-MOD. The OSC-MOD consists of a single-transistor, free-running oscillator that operates at the 2-GHz transmitter output frequency. The varactor diodes which act as voltage-controlled capacitors are held on-frequency by a dc bias from the AFC circuit. A baseband level-adjust control in the OSC-MOD permits precise setting of the deviation. The RF output of the OSC-MOD connects to the driver-amplifier unit via an isolator. For a one-watt amplifier assembly, the driver-amplifier output can be connected directly to the antenna coupling unit. For a five-watt amplifier assembly, the driver-amplifier signal feeds through an isolator into a five-watt power amplifier and then to the antenna coupling unit. (In the event of a failure in the five-watt power amplifier, the RF output from the driver amplifier can be fed to the antenna by using an RF cable to bypass the five-watt amplifier.)

AUTOMATIC FREQUENCY CONTROL

3.07 AFC is an arrangement in which the frequency of the transmitter is automatically maintained with respect to a reference frequency derived from a very stable crystal oscillator. Under proper

operating conditions, the transmitted frequency is 70 MHz removed from the local oscillator frequency. The two frequencies feed into a balanced mixer in an associated AFC unit. The resultant 70-MHz signal is then amplified and divided in half. This 35-MHz signal is then fed to a pilot monitoring circuit and to additional dividing circuits where it is further divided down to 35 kHz. This signal, along with a 35-kHz reference signal which has been divided down from an 8.75-MHz crystal oscillator, is fed to a phase detector where the signals are compared. If the divided signal from the transmitter does not match the reference signal, a dc voltage is sent to the transmitter OSC-MOD to correct the output frequency of the radio.

3.08 Three performance items are monitored in the AFC unit (AFC, PLT, and RF output power). In each case, monitored information is forwarded to the transmitter alarm unit for further processing. The 35 MHz derived for AFC also feeds a pilot monitoring circuit which first amplifies the signal and then recovers the original pilot frequency by means of a discriminator. The demodulated pilot is then amplified and fed to a pilot monitoring circuit in the transmitter alarm. The mixer current generated in the balanced mixer is fed to the transmitter alarm where it is used to monitor transmitter output power.

ANTENNA EQUIPMENT

3.09 In an NP assembly, the transmitter output continues to the antenna coupling unit which provides an RF bandpass filter tuned to pass the transmit frequency and to reject transmitter noise at the receiver frequency. The output is routed from the bandpass filter through either a circulator or a four-port circulator to the antenna port. For reduced transmitter RF power, an attenuator can be placed before the transmitter bandpass filter.

3.10 In the MHS assembly, the RF outputs of the two transmitters connect to the antenna coupling unit through coaxial cables. Under normal conditions, a coaxial or diode switch, actuated by the MHS control logic, connects transmitter A to the antenna and terminates transmitter B into a 50-ohm load. Should transmitter A fail, the MHS control unit will terminate transmitter A and connect transmitter B to the antenna.

3.11 The output from the coax or diode switch connects via semi-rigid, low-loss coaxial cable to an RF bandpass filter in the antenna coupling unit which is tuned to pass the transmit frequency and stop transmitter noise at the receive frequency. The output of the filter connects to a circulator or a four-port circulator (low VSWR) which combines transmit and receive signals on a common transmission line and antenna. RF attenuators may be placed before the RF switch to reduce transmitter RF power.

TRANSMITTER ALARMS

3.12 An alarm condition registered for any of the three monitored functions will activate a transmitter alarm. In an MHS assembly, the alarm will also key the better performing transmitter in-service. The three alarm functions are:

(a) Low RF Power: a reduction in RF output of 3 dB from the nominal 1 or 5-watt amplifier output.

(b) Pilot: loss of continuity pilot through the transmitter or a drop in pilot level of 8 dB.

(c) AFC: loss of automatic frequency control.

3.13 The RF output power, pilot, and AFC voltage of the transmitters are monitored by circuitry in the AFC unit. An alarm condition for any of the three is reported into alarm circuitry of the transmitter alarm. An alarm condition in any of the three alarms will de-energize a summed alarm relay, which provides an alarm indication to external office equipment and lights a red ALM indicator on the face of the transmitter alarm.

ADDITIONAL MHS ALARMS

3.14 In general, the MHS control can be strapped to prefer A or B transmitter. Under normal operating conditions, the preferred transmitter is connected to the antenna.

A. Preferred Transmitter Failure

3.15 If the preferred transmitter is terminated after an alarm indication, and if the other transmitter subsequently indicates an alarm, the logic reverts to the preferred transmitter.

3.16 A three position switch on the MHS control unit allows for either manual selection, or automatic operation. The switch will override transmitter alarms or external controls. Transmitter selection can be made remotely by non-latching external control inputs.

B. Double Pilot Alarm

3.17 In the event of simultaneous pilot alarms from both transmitters, the logic will select the preferred transmitter, since it is likely that a pilot oscillator failure has occurred.

C. AFC Failure

3.18 If a transmitter operating in the manual selection mode loses frequency control, a fixed voltage is applied to the oscillator-modulator varactor which will hold the transmitter at or near center frequency, permitting communication, but without AFC correction.

4. ELECTRICAL DESCRIPTION OF RECEIVER

GENERAL

4.01 An NP or LP assembly has one receiver. An MHS assembly has two receivers tuned to the same frequency and associated alarm/control units. In each case, the complete receiver assembly consists of receivers and associated baseband equipment.

ANTENNA EQUIPMENT

4.02 Receiver antenna equipment for NP, LP, and MHS assemblies is located in the antenna coupler. In the NP, LP, and MHS assemblies, received signals enter the antenna coupling unit and pass through a circulator or a four-port circulator (low VSWR). The signals continue through an RF bandpass filter and on to the receiver input. (For NP, LP, MHS, and space diversity receivers, the RF signal passes through an isolator to the receiver input.)

4.03 For common antenna protected receivers, the RF signal passes through an isolator to an RF preselector filter, and then to the receiver input. For special interference requirements, or frequency assignments, a narrow preselector may replace the standard preselector. The filters serve as preselectors to isolate the receivers from unwanted signals, and to stop associated transmit power at the receive frequency.

RF-IF EQUIPMENT

4.04 Except for MHS single antenna systems, receive signals pass through a 2-GHz RF bandpass filter tuned to accept the receive frequency and reject the frequency of the associated transmitter. The selected signals pass through a 2-GHz amplifier and an RF bandpass filter (omitted in low-noise FD assembly receivers) to a mixer preamplifier circuit where they are combined in a balanced mixer with a 2-GHz signal from a crystal controlled local oscillator. The resulting difference frequency of 70 MHz is amplified in a low noise IF preamplifier. The signal is then passed through a 70-MHz IF filter-equalizer (of 14-MHz bandwidth) to an IF amplifier. The IF amplifier gain is controlled by AGC voltage. The AGC amplifier also has a provision for manual control of the IF amplifier and has an AGC meter output to indicate receiver signal strength on the meter panel. When the IF signal falls below a preset level, the 70-MHz signal path is switched through a narrow filter (6 or 10 MHz) for increased selectivity. From the IF amplifier, the 70 MHz is applied to the limiter demodulator where amplitude variations are removed and the signal demodulated.

4.05 The baseband output of the limiter demodulator is cabled to the receiver baseband amplifier. The signals are de-emphasized and amplified in this unit. The signals then pass through contacts of a normally energized mute relay to the receive section of the interface unit via BNC jacks and a coaxial cable. A TEST OUT jack is available on the faceplate of the baseband amplifier. A noise, pilot, and a dc alarm (to indicate final baseband amplifier failure) output is provided for connection to the receiver alarm unit. The NP, or LP, baseband amplifier has a loop pilot extraction circuit to provide the low frequency pilots for the loop switch interface unit.

4.06 The interface unit consists of a resistive splitting network which provides three baseband outputs. On protected systems, a monitor jack is also provided. All interface outputs are via BNC jacks located on the faceplate of the interface unit. In protected assemblies, the low impedance outputs of the two receiver baseband amplifiers are tied together in the interface unit and build-out resistive pads provide the desired output level and 75-ohm source impedance. When a link between the interface unit and a baseband amplifier is removed, or when a receiver is muted, the baseband output remains unchanged. In NP, or LP assemblies, the low impedance output of the receiver baseband amplifier is connected to a 75-ohm build-out resistive network which provides three baseband outputs.

RECEIVER CONTROL AND ALARM

4.07 For NP systems, three functions are sampled from the baseband amplifier. They are: noise (NODAN), system pilot, and the dc operating point of the amplifier. These monitored signals are passed to the receiver alarm unit. An alarm condition registered for any of the functions will light an alarm indicator on the face of the receiver alarm unit and will de-energize a summed alarm relay. In an NP system, the receiver alarm unit controls the mute relay of the baseband amplifier.

4.08 To control the mute relay, the receiver alarm can be strapped to mute the receiver upon detection of any of the three monitored alarms or it can be strapped to mute the receiver only upon detection of a NODAN alarm.

4.09 In a protected system the receiver alarm unit monitors four functions: noise (NODAN), pilot, the dc operating point of the baseband amplifier, and a malfunction of the noise log amplifier. An alarm condition registered for any of these functions will light an alarm indicator on the faceplate of the unit and will de-energize a summed alarm relay. In addition, a log amplifier provides a voltage proportional to the log of the receiver noise which is forwarded to the receiver control unit. The receiver alarm unit also forwards pilot and NODAN alarms to the receiver control. The receiver control unit of a protected radio controls the mute relays of the baseband amplifiers.

4.10 The receiver control logic is arranged so that the detection of either a pilot or a NODAN alarm on either of the two receivers will mute that receiver. Once an alarm indication has muted a particular receiver, the other is locked on even if a pilot alarm is subsequently detected on the "good" receiver. A NODAN alarm, however, will always mute a receiver; thus, if only a pilot alarm is detected on one receiver and a subsequent NODAN alarm is detected on the other, the receiver with a NODAN alarm will be muted while the receiver with pilot alarm will be put back into service. If both receivers register NODAN alarms, both will be muted.

4.11 In addition to the alarm logic, the receiver control unit also compares the noise voltage provided by the log amplifiers in each receiver alarm unit. The receiver control can be strapped for either optimal selection mode or combining mode. In the optimal selection mode, only one receiver will be in service at any time. The receiver control will mute the noisier receiver. Once muted, a receiver must

become 3-dB quieter than the other before it can be switched back in service and the other receiver muted.

4.12 When strapped in the combining mode, the receiver control will leave both receivers on-line as long as both receivers are functioning normally with equal or near-equal noise levels. Under these conditions, a 3-dB S/N advantage will be achieved over the S/N ratio of a single receiver. When one receiver becomes approximately 6-dB noisier than the other, this advantage is overcome. Therefore, the noise comparison logic circuit mutes the noisier receiver, disconnecting it from the common output. Pilot and NODAN alarms will always override the noise comparison logic.

4.13 In addition to automatic switching of receivers by either alarm or noise comparison logic, a remote control feature is provided which will override automatic switching on alarms but not manual switching. Either receiver can be selected remotely. A remote selection will energize a lock alarm relay for customer alarm equipment and will light a lock alarm indicator on the face of the receiver control unit. To remove a remote command, a reset signal (either from a remote location or from a reset pushbutton on the receiver control unit) must be applied. The lock alarm indicator will extinguish, the relay will de-energize, and the receiver control will return to automatic operation.

4.14 A switch on the receiver control unit is provided to manually select one receiver in-service and one receiver out-of-service for testing. The manual control will override automatic and remote switching commands. The switch is normally in the AUTO position. Either receiver can be selected manually. A manual selection will also energize the lock alarm relay and light the lock alarm indicator. Switching back to AUTO will restore automatic (or remote) control, de-energize the relay, and extinguish the alarm indicator.

RECEIVE PILOT ALARM

4.15 The baseband input from the receivers is sampled and passed to a pilot receiver circuit in the receiver alarm unit where it is amplified, detected, and passed through an alarm comparator to the receiver logic. Interruption of the system pilot, or an 11 dB drop in pilot level is detected by the alarm comparator and the logic circuit registers an alarm. In the MHS assemblies, the receiver is also muted, however, if both receivers register a pilot alarm simultaneously, the receiver control logic ignores the alarms. This is done because a double pilot alarm is more indicative of a pilot oscillator failure than a failure of both receivers.

NODAN ALARM

4.16 In an NP assembly, noise is sampled in a slot above the baseband, amplified, detected, and fed into a NODAN threshold detector. If the noise rises above a preset level (normally 58.5 dBrnc0) the NODAN alarm causes the logic circuit to register an alarm and mute the receiver.

4.17 In protected assemblies, the noise is also sampled in a slot above the receiver baseband, amplified, detected, and fed to a NODAN alarm circuit and a log amplifier. (Log amplifier operation is described in paragraphs 4.11 and 4.12.) If the noise rises above a preset level (normally 58.5 dBrnc0) the NODAN alarm is forwarded to the receiver control to register an alarm and mute the receiver (unless the receiver control is in manual or remote operation). A NODAN alarm will also de-energize the summed alarm relay and light the NODAN alarm indicator on the faceplate of the receiver alarm unit.

BASEBAND AMPLIFIER MALFUNCTION

4.18 A dc voltage generated within the baseband amplifier falls within certain limits when the amplifier is functioning normally. A failure of the final amplifier in

the baseband path causes the dc voltage to rise above or drop below this range and initiate an alarm. In NP or MHS assemblies, a dc alarm will generate a pilot alarm to de-energize the summed alarm relay for customer office equipment and light the pilot alarm indicator on the alarm unit faceplate. The alarm is forwarded to the receiver control where the receiver may or may not be muted depending on alarm conditions in the other receiver.

NOISE AMPL ALARM

4.19 In protected assemblies, the noise and log amplifiers are monitored to guard against a receiver silent failure when in fact only the noise amplifier or log amplifier has malfunctioned. When the noise voltage from the log amplifier drops below a certain level, it is detected as a failure. The noise amplifier alarm will light an indicator on the receiver alarm unit and de-energize the summed alarm relay. In addition, the noise voltage forwarded to the receiver control will now indicate a "noisy" receiver. The receiver control logic will mute the receiver.

5. METERING

5.01 An assembly meter and selector switch are mounted on the left side of the radio assembly to monitor equipment performance. When the switch is set to the appropriate position, the meter indicates transmitter output power or the receiver AGC voltage for the assembly (A and B at protected assemblies or non-protected repeaters). Additional measurements can be made at test points on individual units by placing the selector switch to +EXT or -EXT position and using the meter test lead.

5.02 For measurements made at blue test points, connect meter test lead between 100 μA jack on meter and blue test point; for measurements made at red test points, connect meter test lead between 30V jack on meter and red test point. Calibration controls are located on the side of the assembly meter. They are used to calibrate meter movement (CALIBRATE METER) and transmitter output power indications (CALIBRATE XMTR A PWR and CALIBRATE XMTR B PWR).

6. LOOP PROTECTED SYSTEMS

6.01 This section describes the operation of the BB interface and loop switch unit in a single loop system using non-protected assemblies.

6.02 The single loop system consists of a number of microwave sites arranged geographically so that the microwave paths form a closed loop (see Fig. 1). However, the baseband transmission path around the loop is normally blocked and terminated at one of the sites (the master site). This loop arrangement results in two transmission paths being available from the master terminal to any other site; the normal path is counterclockwise from the master terminal and the other path will be clockwise if an alarm occurs and the normally blocked baseband is allowed to pass. Loop-protected systems therefore obtain their protection capability through alternate routing of the baseband signal. This is done automatically by protection switching equipment designed for the loop-system application.

6.03 The basic loop system consists of two types of stations: one master plus a number of repeaters. Both types utilize non-protected FL1-2 radio assemblies to provide a duplex RF path between adjacent sites. This arrangement requires two transmitter-receiver pairs per duplex RF path. Automatic switching equipment located at the master station monitors the status of the baseband path around the loop. Should a failure be detected, the alternate path is established to restore communication between all sites.

6.04 Each repeater station (B through D, Fig. 1) is equipped with a transmitter and receiver switch between the radio baseband amplifiers and the external baseband

treatment equipment. The radio's baseband is switched on the combined side of a multiple-port baseband combining input and output splitting circuit. The multiple ports eliminate in most cases a four-wire bridge for baseband treatment. Each loop switch at a repeater station is controlled by the summed alarm output from its associated receiver. When the loop switch units are in the AUTO position and there are no alarms, a full duplex transmission path is maintained through the repeater. When an alarm occurs, the transmitting and receiving baseband paths associated with the alarmed receiver are automatically blocked and terminated.

6.05 The master station (A, Fig. 1) also is equipped with loop switches between the radio baseband amplifiers and the external baseband treatment equipment. However, one of the switches at the master station is normally in the BLOCK position (no alarms). The master station transmits two low-frequency system pilots (F1 and F2) in opposite directions around the entire system (F1 counterclockwise, F2 clockwise). The master station looks for the return of both pilots to verify system continuity. During normal operation (no alarms) and with both system pilots being detected, the master station baseband path facing station D is blocked and terminated by the loop switch.

6.06 Each radio transmits a continuity pilot between adjacent sites, that is, the pilot is stopped and reinserted on each hop. Loss of radio pilot or a NODAN alarm will activate a receiver summed alarm, which will force the associated loop switch relays to their BLOCK position, isolating the failed hop and interrupting both of the system loop pilots (F1 and F2). The pilot monitoring equipment at station A senses the loss of both pilots and operates the normally BLOCK loop switch relays to the PASS position, allowing full duplex operation clockwise around the loop to the failed hop. Station A radios are now transmitting baseband information in both directions and system integrity is restored. Note that both loop pilots must be missing before station A will switch.

6.07 When the equipment on the failed hop is restored to service, the summed alarm initiating the switch will clear. Once the alarm has cleared, the loop switch relays on the failed hop will return to their normal PASS position. This will restore the normal baseband route at the failed station and the two system pilots will reappear at the master station. As soon as the master station sees a loop pilot it will command the normally BLOCK loop switch relays to return to the BLOCK position. Thus, the loop switch will again BLOCK the master station baseband path facing station D and the system will return to normal.

6.08 A red indicator designated SWITCH ALM, on the BB interface and loop switch unit, lights whenever a switch is off-normal (BLOCK or PASS). A yellow indicator labeled MAN CONT indicates whenever a manual switch or lockup is in effect.

6.09 The loop switch circuits operate in three possible modes: automatic, manual, and remote.

Automatic Mode

6.10 When the switch on the BB interface and loop switch unit is in the AUTO position, the loop switches are under control of the logic circuits in the BB interface and loop switch unit. Summed alarm signals from the associated receiver, or the loop pilot detector alarms at the normally blocking master terminal, are sensed and evaluated by the input logic circuits of the BB interface and loop switch unit.

6.11 Strapping options in the BB interface and loop switch unit allow selection of the PASS or BLOCK mode for normal (no alarm) operation. When the PASS mode is selected as normal, switching is controlled by the associated receiver's summed alarm and switching occurs whenever a pilot or NODAN alarm is registered.

6.12 When the BLOCK mode is selected as the normal mode of operation, switching will occur whenever both loop pilot detectors register loss of pilot and there are no associated receiver alarms.

6.13 Additional switching logic is provided in the BB interface and loop switch unit for coodinating the switching operation whenever the unit is used as the second BLOCK mode switch in a double loop master station. This additional logic allows the normal loop pilot detector inputs for the second loop to be overriden in the event both master station receivers in the first loop fail, since this double receiver failure will only interrupt one of the loop pilots. This override closes the normally blocking loop switches on the second loop and restores communication with the master terminal.

Manual Mode

6.14 Placing the manual switch on the BB interface and loop switch unit to either PASS or BLOCK puts the loop switches under local control and overrides all automatic and remote commands. Manual control allows equipment to be switched/locked in or out of service for maintenance or testing.

Remote Mode

6.15 The loop switches can be remotely switched to PASS or BLOCK through the remote control inputs to the BB interface and loop switch unit. Remote control overrides the automatic mode of operation but not the manual mode.

7. REFERENCES

BL-101269 - Block and Level Diagram, FL1-2 Non-Protected Assembly
SD-101269 - Schematic Diagram, FL1-2 Non-Protected XMTR-RCVR Assembly
BL-101270 - Block and Level Diagram, FL1-2 MHS Assembly
SD-101270 - Schematic Diagram, FL1-2 MHS XMTR and RCVR Assembly
BL-101241 - Block and Level Diagram, Transmitter Assembly
SD-101241 - Schematic Diagram, Transmitter Assembly
BL-101242 - Block and Level Diagram, Receiver Assembly
SD-101242 - Schematic Diagram, Receiver Assembly

Table A

Specifications

GENERAL

CHANNEL CAPACITY	W 300	300	U 480	Y 600
PER CHANNEL RMS DEVIATION	200 KHz	280 kHz	200 kHz	140 kHz
EMISSION DESIGNATOR	10,000F9	10,000F9	10,000F9	10,000F9
INTERNAL CONTINUITY PILOT	1499 or 1975 kHz	1499 or 1975 kHz	3200 kHz	3200 kHz
LOADED WORST CHANNEL NOISE 0° to +50°C (with CCIR type emphasis) (1)	17.8 dBrnc0 56.0 pWp0 54.0 dB NPR	17.8 dBrnc0 45.0 pWp0 54.5 dB NPR	20.5 dBrnc0 87.0 pWp0 52.0 dB NPR	21.0 dBrnc0 102.0 pWp0 51.0 dB NPR
BASEBAND FREQUENCY RANGE	0.3-1300 kHz	0.3-1300 kHz	0.3-2044 kHz	0.3-2792 kHz
IF BANDWIDTH (3-dB points approx.)				
NORMAL RECEIVE LEVEL LOW RECEIVE LEVEL	14 MHz 6 MHz	14 MHz 6 MHz	14 MHz 10 MHz	14 MHz 10 MHz
30 dB S/N THRESHOLD	-88 dBm	-91 dBm	-84 dBm	-79 dBm
FL1-2-01 SYSTEM GAIN Non-Protected MHS (2)	 116.5 dB 115.0 dB	 119.5 dB 118.0 dB	 113.5 dB 112.0 dB	 108.5 dB 107.0 dB
FL1-2-02 SYSTEM GAIN Non-Protected MHS (2)	 123.5 dB 122.0 dB	 126.5 dB 125.0 dB	 120.5 dB 119.0 dB	 115.5 dB 114.0 dB

(1) Noise performance is specified at recommended received RF levels at antenna port.

(2) System gain values are for MHS transmitters with space diversity receivers. Protected receivers with equal-loss hybrid have 3.5 dB more insertion loss. With a directional coupler, the additional losses are 1.0 dB (RCVR A) and 11.0 dB (RCVR B).

Table A (Cont)

ASSEMBLY

Frequency Range	1850 to 1990 MHz	
Power Output (at antenna port)	FL1-2-01	FL1-2-02
	(-21 to -28 Vdc)	(-25.5 to -28 Vdc)
Non-Protected	0.89 watt +29.5 dBm	4.5 watt +36.5 dBm
Monitored Hot Standby		
Coaxial Switch	0.79 watt +29 dBm	4.0 watts +36 dBm
Diode Switch	0.63 watt +28 dBm	3.2 watts +35 dBm
Power Requirements		
Unprotected		
Typical	44W	85W
Maximum	50W	95W
Protected		
Typical	100W	175W
Maximum	110W	200W
Power Sources		
Standard	-24 (-21 to -28) Vdc	
Optional External Power Supplies	-48 (-42 to -56) Vdc 115/230 Vac ±10%	
Channel Capacity	300, 480, and 600	
Emphasis	CCIR	
Altitude	15,000 ft (4572 m)	
Humidity	95% at +40°C	
Temperature Range		
Full Performance Specifications	0° to +50°C (0° to +122°F)	
Operation	-30° to +55°C (-22° to +131°F)	
Storage	-40° to +65°C (-40° to +149°F)	

Table A (Cont)

MOUNTING DIMENSIONS

	Rack Spaces	mm	inches
Vertical			
Terminal			
Non-Protected	20	889	35
Protected	20	889	35
Repeater			
Non-Protected	20	889	35
Protected (per rack)	40	1778	70
Horizontal		483	19
Depth			
Overall		419	16.5
Projects from front of rack		127	5
Projects from rear of rack		216	8.5

CONNECTIONS

Antenna	N Female
Baseband	BNC Female

BASEBAND (excluding BB treatment components)

Test Tone Levels	
Transmitter Input	-35/-25/-25 dBm
Receiver Output	-15/-25/-25 dBm
Impedance	75 ohms, unbalanced
Return Loss	
0.3 kHz to top BB frequency	26 dB
Frequency Response	
0.3 kHz to 4 kHz	±1.5 dB
4 kHz to top BB frequency	±0.25 dB
Spurious Tones	
60 kHz to top BB frequency	-70 dBm0

TRANSMITTER

Type	Frequency Modulation
Frequency Stability	
-30° to +50°C	±0.00025%

Table A (Cont)

RECEIVER

Type	Single Conversion Superheterodyne
Noise Figure (at antenna port)	7.5 dB, maximum
Image Rejection	70 dB, minimum
Intermediate Frequency	70 MHz
RF Bandwidth (3 dB)	40 MHz, nominal, standard 15 MHz or 30 MHz, nominal, optional
RF Level (at antenna port)	-30 dBm, maximum

ALARMS AND INDICATORS

Standard	
Transmitter	Low RF Power (LED) AFC (LED) Loss of Pilot (LED) Summed Alarm (relay)
Receiver	Loss of Pilot (LED) NODAN (LED) BB Amplifier Failure Noise Amplifier Failure (LED) Protected Summed Alarm
Power Supply	Power Supply (LED)
Additional for Monitored Hot Standby	XMTR A In Service (LED) XMTR B In Service (LED) Manual Control (LED) XMTR Lock Alarm (switch contact) RCVR Lock Alarm (LED and relay)

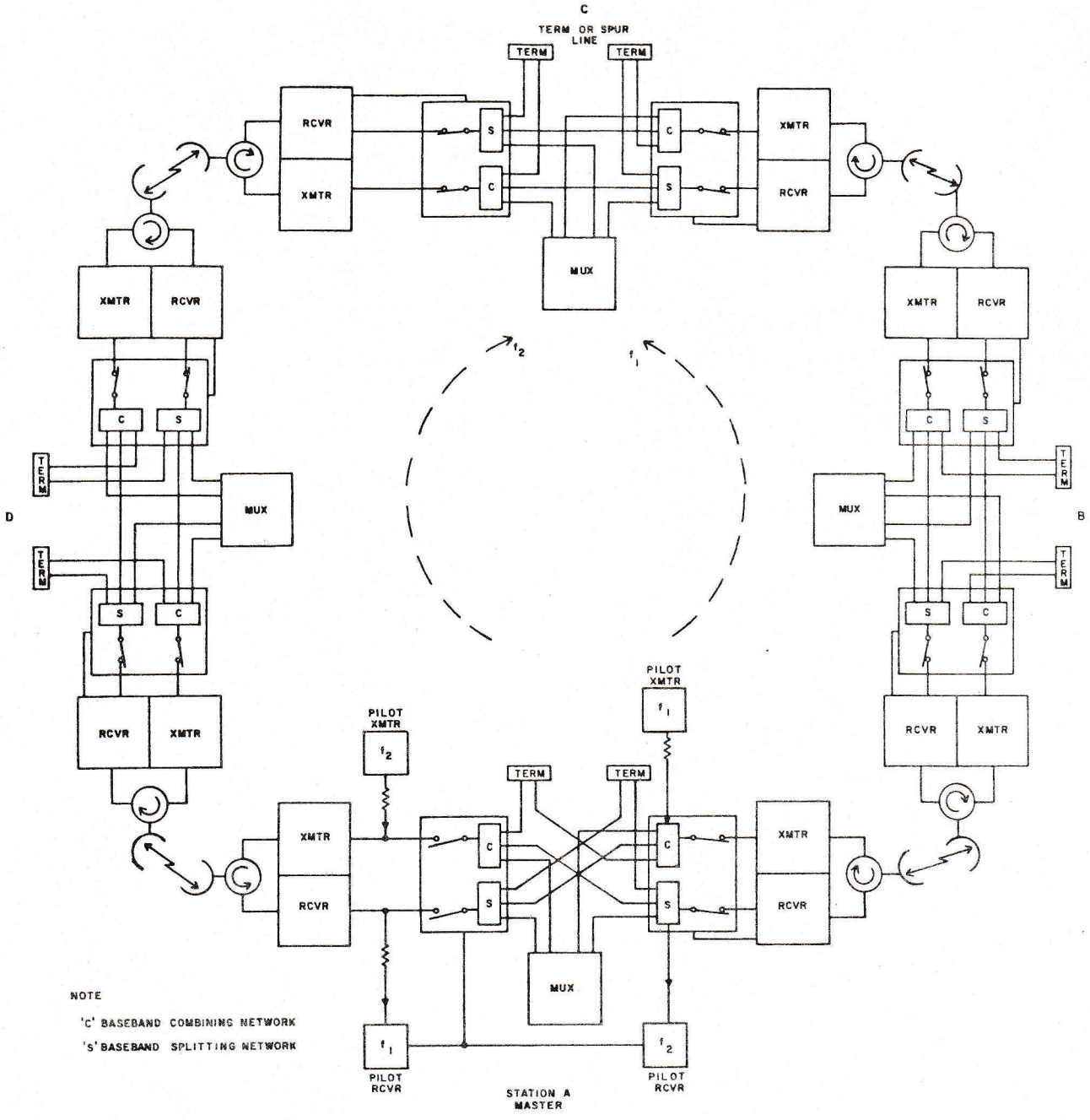


Fig. 1—Typical Loop Microwave System
(Non-Protected, Full Duplex Loop)

ALIGNMENT PROCEDURE

FARINON TYPE FL1-2 MONITORED HOT STANDBY

MICROWAVE RADIO

GENERAL

These alignment procedures describe the checks and adjustments necessary to place a Farinon FL1-2 Monitored Hot Standby Microwave Radio System in service and to verify proper operation.

INITIAL INSTALLATION PROCEDURES

Perform Charts 1 through 12 on initial installation, and Chart 13 after all other tests are completed. During initial installation the test indications should be logged on maintenance log forms.

Performance requirements for the initial installation tests are given in the appropriate test CHARTS. In-station testing should be performed and must meet the in-station performance requirements before proceeding with the terminal-to-terminal tests.

RECOMMENDED MAINTENANCE INTERVALS

The following CHARTS should be performed routinely. Periodic performance of these tests will determine the degree of degradation, if any, in performance as compared to the performance at the time of initial installation. During these tests, the individual indications should be logged on maintenance log forms.

Perform Charts 2 through 10 at 12-month intervals and Charts 11 through 14 as required.

Note: When units or subassemblies are replaced, the meter indications may change. After equipment has been realigned, a new reference indication should be entered on the log form for any factory data that is no longer valid.

TEST EQUIPMENT

Equipment used in alignment checks is listed in Table A. In addition, the specific equipment required for each check is listed under APPARATUS in the front of each CHART. The manufacturer's name and number used in Table A and the APPARATUS sections of each CHART are given for reference only; any piece of test equipment that has operational characteristics and parameters equal to those listed or which meet the standards set by the local licensing authority may be used.

Where SVM (EVM) is indicated together in the procedure, a signal can be measured by two methods. The use of a Frequency Selective Voltmeter (SVM) is preferred, but an Electronic Voltmeter (EVM) can also be used. Where only one meter is specified in the test, it alone must be used.

When measuring the WIDEBAND NOISE LOADING LEVEL with an average-responding electronic voltmeter (i.e., 400EL) the level will measure 1.1 dB low. Readings on average-responding meters should be corrected before comparison to their requirements.

Wideband voltmeters with 600-ohm scales used for setting reference drive, measure 9 dB low when terminated in 75 ohms.

The procedures that follow assume that personnel performing these procedures are familiar with all of the test equipment in accordance with manufacturer's manuals. Only specific instructions unique to the FL1-2 Systems are given, except when simple operating instructions are repeated for clarity. Specific test equipment alignments and adjustments should be obtained from the manufacturer's manual(s) provided with test equipment.

All test equipment should be calibrated before use and allowed to warm-up and stabilize for at least one hour before making checks.

FACTORY TESTING

Each Farinon FL1-2 Transmitter/Receiver assembly is set up, aligned and tested end-to-end at the factory. During these tests pertinent data is recorded on the Factory Test Data, which becomes a part of the instruction manual. This information may be used as a guide for proper operation of the equipment and will be referred to in some of the following procedures. Verify that the serial number recorded in the Factory Test Data agrees with the serial number of the equipment being tested.

Also shipped with each Farinon system is the Farinon Wiring List, which contains information on the operational parameters of the equipment and individual assemblies, and options provided on individual assemblies. Verify that the serial number in the Factory Test Data and Farinon Wiring List (FWL) agrees with the foilcal on the equipment for which the data will be used.

Tuning adjustments are not usually required during installation or routine maintenance. Transmitter or receiver touch-up tuning should not be attempted unless required after changing a critical component in the RF path. Only the adjustment called out in the Alignment Procedure should be changed. All other controls have been preset in the factory and should not be adjusted in the field.

PRECAUTIONS

To protect both personnel and equipment from hazardous situations, the test procedures will include the following insertions where applicable:

Danger: ***Warns of potential danger to personnel.***

Caution: ***Advises personnel of possible interference to service.***

Warning: ***Advises personnel of possible equipment damage.***

Note: Qualifies a specific point or instruction in the maintenance procedures.

CHART **PAGE**

Table

CHART 1

PREALIGNMENT CHECKS

This test verifies that extraneous grounds are not present on the input power connectors, that the power source is properly connected, and that the power supplies are delivering the required voltages to the equipment.

APPARATUS:

1--Volt-Ohm Meter (VOM), 20,000 ohms/volt, Triplett 360NA, or equivalent

1--Digital Multimeter (DMM), Fluke 8000A, or equivalent

CHART 1 (Cont)

APPARATUS: (Cont)

1--Coaxial Dummy Load (COAX LOAD), 25 watts, 50 ohms, Engelmann Microwave Corp. T350N

STEP	PROCEDURE
	Before Connecting Power
1	Check the wiring list to determine the operating voltage required by the terminal assembly.
2	Be sure power source voltage (-24 Vdc) is available for equipment.
3	On the power supplies, remove fuses F1-F8 and position the switches down to the OFF position.
	Power Source Voltage Check
4	Apply power to the connectors on rack.
5	With VOM verify that correct voltage and polarity are present on the connectors.
	Requirement: -24 Vdc input: -21 to -28 Vdc.
	Transmitter Voltage Check
6	If a licensing authority requires that the transmitters be terminated during initial warmup and tuning, connect COAX LOAD to antenna coupling unit.
7	Set meter panel switch to OFF position and check that needle rests at 0 μA. (Use small screwdriver to adjust mechanical zero on meter face, if necessary.)
8	Replace fuse F1 in power supply and set the A PWR switch on power connection panel to ON position.
9	Connect DMM (dc measurement, 30V scale) to -20 volt test points on the power supply assembly.
	Requirement: DMM indication of voltage recorded at test point.
	If requirement is not met, adjust the regulator control for a DMM indication of the voltage called for at the test point.
10	Replace fuse F2 and repeat Steps 8 and 9 for the B assembly.

CHART 1 (Cont)

STEP	PROCEDURE
11	Disconnect DMM and set meter panel switch to -EXT. Connect meter test lead between 30V jack on meter and regulator power out test point. **Requirement:** Meter indication of voltage recorded at the test point. If requirement is not met, adjust CALIBRATE MTR control on side of meter for an indication of exactly the voltage recorded at the test point.
12	Replace remaining fuses. **Restoral Procedure**
13	Set switch on MHSB CONT to A ON TEST B.
14	After a 30-minute warmup time, observe the MHSB CONT unit to see that only the MAN CONT and A ON indicators are lit.
15	Set switch on MHSB CONT to AUTO. **Requirement:** Preferred transmitter indicator lights.
16	Set switch on MHSB CONT to B ON TEST A. **Requirement:** B ON and MAN CONT indicators light.
17	Set switch on MHSB CONT back to AUTO.

CHART 2

TRANSMITTER OUTPUT POWER CHECK

Transmitter power is normally measured on the panel meter. The meter indication (in dB) is converted to equivalent output power by referring to the 0 dB calibration level of the meter, given on a foilcal on the meter face.

If greater accuracy is desired, or if the meter indication must be verified, a measurement can be made with a power meter at the circulator output at the power amplifier (1W or 5W). The transmitter must first be removed from serivce.

APPARATUS:

1--RF Power Meter (PWR M), Hewlett-Packard 432, 435 or 436A e/w 478A Thermistor Mount with N-type connector, or equivalent

CHART 2 (Cont)

APPARATUS: (Cont)

1--Attenuator (ATTEN), 30 dB, 20 Watt, Narda 766-30

1--Right Angle Adapter (N to SMA), Farinon 87-19930-14

1--Coaxial Dummy Load (COAX LOAD), 50 ohms, 25 Watts, Engelmann Microwave Corp. T350N

STEP	PROCEDURE

Note: Transmitters should be energized and allowed to stabilize prior to this check.

Caution: If licensing authority requires that the transmitters be terminated during initial warmup and tuning, connect COAX LOAD to antenna port.

Transmitter Output Power Check

1 Set meter panel switch to A PWR OUT.

2 Observe dB scale indication on meter, and convert dB scale indication to the equivalent output power by referring to 0 dB = XX.X dBm on foilcal on the meter face.

Requirement: Minimum Panel Meter Reading

	FL1-2-01	FL1-2-02
MHS (coax switch)	29.0 dBm	36.0 dBm
MHS (diode switch)	28.0 dBm	35.0 dBm

Transmitter Output Power Verification

Warning: For five-watt systems using diode switches, the RF circulator on the power amplifier should not be left unterminated for more than five minutes.

3 Disconnect the cable from the RF circulator connected to the power amplifier. Using right angle adapter, connect a 30 dB attenuated PWR M to the RF circulator, and compare the level reading with that recorded in the Factory Test Data. Also note panel meter indication.

Requirement: Panel meter reading equals PWR M reading minus ACU loss. (ACU loss is recorded in Factory Test Data.)

If the requirement is not met, perform Step 4.

Transmitter Meter Calibration

4 On the side of the meter panel, loosen the locknut on the CALIBRATE XMTR A PWR control. Adjust the control so that meter indicates the output power measured in Step 3, as shown in the following table.

CHART 2 (Cont)

STEP	PROCEDURE

TRANSMITTER METER CALIBRATION

FL1-2-01		FL1-2-02		
Diode Switch	Coax Switch	Diode Switch	Coax Switch	Panel Meter Indication
28.0 dBm	29.0 dBm	35.0 dBm	36.0 dBm	0.0 dB
28.5 dBm	29.5 dBm	35.5 dBm	36.5 dBm	0.5 dB
29.0 dBm	30.0 dBm	36.0 dBm	37.0 dBm	1.0 dB
29.5 dBm	30.5 dBm	36.5 dBm	37.5 dBm	1.5 dB
30.0 dBm	31.0 dBm	37.0 dBm	38.0 dBm	2.0 dB

Note: It will be necessary to estimate the proper meter setting above +2 dB.

5 Tighten the locknut after completing adjustment.

6 Repeat Steps 1 through 5, reversing all A and B references.

CHART 3

TRANSMITTER FREQUENCY CHECK AND ADJUSTMENT

This chart measures the frequency of the transmitter and describes corrective adjustment, if necessary. The frequency measurement is obtained by connecting the electronic counter to the 1-Watt Power Amplifier and adjusting the controlled (closed loop) frequency of the transmitter to within ± 500 Hz of the assigned transmitter output frequency.

Once the closed loop frequency has been established by the adjustment of the AFC unit, the loop is opened. The Oscillator-Modulator is then adjusted, if necessary, to maintain the open loop frequency within ± 1 kHz of the assigned RF output frequency.

Note: During initial installation, the transmitter should be powered for a minimum of 4 hours prior to performing this chart (24 hours preferred). Electronic counter should also be powered for the manufacturer's recommended warm-up time prior to performing this chart. After the first week of continuous operation, this chart should be repeated.

CHART 3 (Cont)

APPARATUS:

1--Electronic Counter (COUNTER), Hewlett-Packard 5245L with Frequency Converter, Hewlett-Packard 5254C or equivalent

1--Coaxial Dummy Load (COAX LOAD), 25-watts, 50-ohms, Engelmann Microwave Corp., T350N (required only during initial installation if the ANT port must be terminated)

1--Patch Cord (SMA to SMA), Farinon 87-10147-10

1--Adapter (SMA to N), Farinon 87-11812-55

STEP	PROCEDURE

Note 1: On initial lineup, the ANT port on the Antenna Coupling unit must be terminated with a COAX LOAD as required by a licensing authority, or the radio must be connected to the antenna.

Note 2: This procedure is designed for maintenance without interruption of service on a protected system. The system must be operating normally with no alarms present.

Note 3: The following procedure has been written for Receiver A/Transmitter A. For Receiver B/Transmitter B, perform the procedure and reverse all A and B references.

Caution: Before judging an AFC unit or Oscillator-Modulator to be defective because a requirement is not met, check (a) calibration of electronic counter, (b) patch cord connections, and (c) drive input to the electronic counter.

Transmitter A Removal from Service

1 Set switch on MHSB CONT to B ON TEST A.

Frequency Check and Adjustment

2 Connect the COUNTER input to the F MON output on Transmitter A 1-Watt POWER AMPLIFIER, using SMA to SMA patch cord and SMA to N adapter.

3 Place switch on Transmitter A AFC unit in the AFC (up) position.

4 Record the frequency on the COUNTER display.

Requirement: Indication should be the transmitter output frequency ± 0.5 kHz (500 Hz).

CHART 3 (Cont)

STEP	PROCEDURE
	If the requirement is not met, adjust the FREQ control on Transmitter A AFC unit very slowly for the correct frequency ± 0.5 kHz. If the requirement is still not met, either the LOCAL OSCILLATOR is defective or the AFC unit may be defective. It is also possible for the COUNTER to be incorrectly calibrated. Refer to the caution at the beginning of this chart.
5	Disable Transmitter A AFC by placing the switch on Transmitter A AFC unit to the MFC (down) position.
6	Record the frequency on the COUNTER display.
	Requirement: Indication should be the transmitter output frequency ± 1 kHz.
	If the requirement is not met, adjust the FREQ ADJ control on the OSCILLATOR-MODULATOR for Transmitter A for the correct frequency ± 1 kHz. If the requirement is still not met, the OSCILLATOR-MODULATOR may be defective. It is also possible for the COUNTER to be incorrectly calibrated. Refer to the cautions at the beginning of this chart.
	Note: For an OSCILLATOR-MODULATOR tuned to the correct frequency at the factory or one in an operating transmitter, the adjustment should not be made more than 1/4 turn from the existing setting. With a replacement OSCILLATOR-MODULATOR, more than 1/4 turn may be needed. In either case, make the tuning adjustment very slowly.
7	Disconnect the COUNTER and set the switch on Transmitter A AFC unit to the AFC position.
	Restore Transmitter A to Service
8	Set switch on MHSB CONT to AUTO.
	Transmitter B Frequency Check and Adjustment
9	Repeat Steps 1 through 8 for Transmitter B. Change all references to Transmitter A to Transmitter B.

CHART 4

RECEIVER CALIBRATION/TRANSMITTER DEVIATION CHECK AND ADJUSTMENT

This chart describes an in-service transmitter deviation check by calibrating a receiver with a signal of known deviation (80402 Baseband Calibrator). The transmitter under test is connected to the calibrated receiver by means of a loopback setup. The transmitter is then modulated with a test tone and its deviation is adjusted to give the proper level out of the calibrated receiver.

CHART 4 (Cont)

APPARATUS:

1--Oscillator (OSC), Hewlett-Packard 651B, Option 2, (equivalent must cover baseband frequency range)

1--Electronic Voltmeter (EVM), Hewlett-Packard 400EL or equivalent

1--Baseband Calibrator (CALIB), Farinon 80402

1--Volt-Ohm Meter (VOM), 20,000 ohms/volt, Triplett 630NA, or equivalent

1--Patch Cord (BNC to BNC), Farinon 87-10146-25

1--Patch Cord (SMA to SMA), Farinon 87-10147-10

1--Adapter (BNC T), Hewlett-Packard 1250-0781

1--Termination (TERM 75 BNC), Farinon 87-11812-53

STEP	PROCEDURE
	Note: The following procedure has been written for Receiver A/Transmitter A. For Receiver B/Transmitter B, perform the procedure and reverse all A and B references.
	Baseband Calibration Preparation
1	Set CALIB selector switch to MOD position and allow 3 minutes for unit to stablize.
2	Connect VOM between BAT (blue) pin jack and case ground of the CALIB.
3	Check CALIB battery voltage under load.
	Requirement: VOM indication of 12.0 Vdc or greater.
	If the requirement is not met, replace the batteries.
4	Connect 75-ohm terminated EVM to 100 kHz jack on CALIB.
	Requirement: EVM indication of -44 ± 0.1 dB (-35 ± 0.1 dBm).
	If the requirement is not met, adjust CAL control on CALIB until requirement is met.

CHART 4 (Cont)

STEP	PROCEDURE
	Receiver Calibration
5	Set switch on RCVR CONT unit to B ON TEST A position. (This frees Receiver A for testing.) **Requirement:** LOCK ALM indicator on RCVR CONT unit should light.
6	Disconnect coaxial cable from IN jack on IF FILTER EQL unit for Receiver A. **Requirement:** PLT and NODAN indicators on RCVR ALM unit light. TH EXT indicator on IF AMPL unit lights.
7	Connect 70 MHz OUTPUT jack on CALIB to IN jack on IF FILTER EQL unit. Use BNC to BNC patch cord.
8	Connect 75-ohm terminated EVM to TEST OUT -30 dBm jack on RCVR BB AMPL unit for Receiver A as shown in Fig. 3.
9	Set CALIB selector switch to MOD position and observe EVM indication. **Requirement:** EVM indication should be: -36.5 dB (-27.5 dBm) ± 0.25 dB (transmitter with 200 kHz deviation; or -39.4 dB (-30.4 dBm) ± 0.25 dB (transmitter with 280 kHz deviation); or -33.3 dB (-24.3 dBm) ± 0.25 dB (transmitter with 140 kHz deviation). **Note:** EVM indication is not test tone level. If the requirement is not met, adjust LEV ADJ control on RCVR BB AMPL unit for receiver under test for required indication.
10	Set CALIB selector switch to CW position and set meter panel switch to AGC for receiver under test. **Requirement:** Assembly meter should indicate approximately 100 μA. EVM indication of -60 dB or lower. If the requirement is not met, receiver is not quieting properly or CALIB is faulty. Repeat Steps 1 through 10 if corrective action is taken.
11	Remove CALIB and restore coaxial cable to IN jack on IF FILTER EQL unit.
12	Repeat Steps 1 through 11 for Receiver B and then continue with Step 13. Reverse all A and B references.
13	Set switch on RCVR CONT unit to B ON TEST A position.

CHART 4 (Cont)

STEP	PROCEDURE
	Requirement: LOCK ALM indicator on RCVR CONT unit lights.
	Transmitter A Removal from Service
14	Set switch on MHSB CONT unit to B ON TEST A position.
	Requirement: A ON indicator on MHSB CONT unit extinguishes and B ON indicator lights. MAN CONT indicator on MHSB CONT unit lights.
15	Remove coaxial cable at NORMAL LINK TO J1 BB AMPL for Transmitter A and connect it to TEST LINK TO J1 BB AMPL jack on BB INTERFACE unit.
	Transmitter A to Receiver A Loopback
16	Connect the IF TEST connector on Transmitter A AFC unit to the IF TEST connector on Receiver A MIXER-PREAMPLIFIER unit. Use an SMA to SMA test cord.
17	Disconnect the LO power cable. (Assembly meter AGC indication may read off scale but this should not cause concern.)
	Transmitter A Deviation Check and Adjustment
18	Set the OSC to a frequency of 100 kHz and an output level of -34 dB (-25 dBm) with an EVM (SVM). Refer to Fig. 1 for the test setup.
19	Connect the OSC to the A TEST IN jack on BB INTERFACE unit. Refer to Fig. 2 for the OSC setup.
20	Connect a 75-ohm terminated SVM (EVM) to the TEST OUT jack on Receiver A RCVR BB AMPL unit. Refer to Fig. 3 for the SVM (EVM) setup.
	Requirement: EVM (SVM) should indicate -39 dB (-30 dBm) ± 0.2 dB.
	If the requirement is met, Transmitter A is properly adjusted.
	If the requirement is not met, adjust the BB LEV control on Transmitter A OSCILLATOR-MODULATOR unit to meet the requirement.
	Restoral Procedure
21	Disconnect OSC and EVM (SVM).
22	Disconnect cable at TEST LINK TO J1 BB AMPL jack for Transmitter A and reconnect it to NORMAL LINK TO J1 BB AMPL jack on BB INTERFACE unit.

CHART 4 (Cont)

STEP	PROCEDURE
23	Remove loopback cable between Transmitter A and Receiver A.
24	Reconnect Receiver A LO power cable.
25	Set switch on RCVR CONT unit to AUTO position. **Requirement:** LOCK ALM indicator on RCVR CONT unit extinguishes.
26	Set switch on MHSB CONT unit to AUTO position. **Requirement:** MAN CONT indicator on MHSB CONT unit extinguishes.

CHART 5

BASEBAND FREQUENCY RESPONSE: TEST RECORD AND SUBSEQUENT CHECKS

This chart describes an in-service baseband frequency response check using a loopback setup.

Caution: During initial installation, perform Chart 13 prior to performing this chart.

APPARATUS:

1--Oscillator (OSC), Hewlett-Packard 651B, Option 2, (equivalent must cover baseband frequency range)

1--Electronic Voltmeter (EVM), Hewlett-Packard 400EL or equivalent

1--Patch Cord (BNC to BNC), Farinon 87-10146-25

1--Adapter (BNC T), Hewlett-Packard 1250-0781

1--Termination (TERM 75 BNC), Farinon 87-11812-53

STEP	PROCEDURE
	Note: The following procedure has been written for Receiver A/Transmitter A. For Receiver B/Transmitter B, perform the procedure and reverse all A and B references.

CHART 5 (Cont)

STEP	PROCEDURE
	Transmitter A to Receiver A Loopback
1	Connect the IF TEST connector on Transmitter A AFC unit to the IF TEST connector on Receiver A MIXER-PREAMPLIFIER unit. Use an SMA to SMA patch cord.
2	Disconnect Receiver A LO power cable. (Assembly meter AGC indication may read off scale, but this should not cause concern.)
3	Verify that alarm indicators on both XMTR ALM units are extinguished.
4	Set switch on MHSB CONT unit to B ON TEST A position.
	Requirement: MAN CONT indicator on MHSB CONT unit lights.
5	Set OSC to 100 kHz and adjust output level to -34 dB (-25 dBm). Connect OSC and EVM as shown in Fig. 1.
6	Remove coaxial cable at NORMAL LINK TO J1 BB AMPL jack for Transmitter A and connect it to TEST LINK TO J1 BB AMPL jack on BB INTERFACE unit.
	Reference Level Check
7	Connect OSC to TEST IN -25 dBm jack for Transmitter A on BB INTERFACE unit using BNC to BNC patch cord. See Fig. 2.
8	Connect 75-ohm terminated EVM to TEST OUT -30 dBm jack on Receiver A RCVR BB AMPL as shown in Fig. 3. (The following requirement is for subsequent checks. If this is initial alignment, continue with Step 9.)
	Requirement: EVM indication of -39 dB (-30 dBm) ± 0.2 dB.
	If the requirement is met, continue with Step 14.
	If the requirement is not met, perform Chart 4 and then continue with Step 14.
	Baseband Frequency Response Check (Initial Alignment Only)
9	Remove one of the record sheets (supplied at the end of this chart) and record the Transmitter/Receiver setup in the heading.
10	Record the frequencies given in the Factory Test Data, in the FREQUENCY column on the record sheets.
11	Record the level observed in Step 8 in the 100 kHz space.

CHART 5 (Cont)

STEP	PROCEDURE
12	Change the OSC frequency, one frequency at a time, to each frequency on the record sheet and record the EVM indication in the INITIAL MEASUREMENT column. **Note:** The OSC output level should be checked with EVM and adjusted, if necessary, to maintain the -34 dB (-25 dBm) level.
13	Return the record sheet to the end of this chart and then continue with Step 16.
	Baseband Frequency Response Check (Subsequent Checks) **Note:** This step uses the frequency response record sheet at the end of this chart as a standard for comparison with the observations taken below.
14	Change OSC frequency, one frequency at a time, to each frequency on the record sheet and observe EVM indication. **Requirement:** EVM indications (segmented frequency response) 4 kHz to top of BB frequency: ± 0.25 dB; 300 Hz to 4 kHz: ± 1.5 dB. No adjustment for frequency response is provided. If the requirement is not met, trouble shoot Transmitter A/Receiver A for a faulty unit.
15	Return the record sheet to the end of this chart and continue with Step 16.
	Restoral Procedure
16	Disconnect OSC and EVM.
17	Disconnect cable at TEST LINK TO J1 BB AMPL jack for Transmitter A and reconnect it to NORMAL LINK TO J1 BB AMPL jack on BB INTERFACE unit.
18	Remove loopback cable between Transmitter A and Receiver A.
19	Reconnect Receiver A LO power cable.
20	Set switch on RCVR CONT unit to AUTO position. **Requirement:** LOCK ALM indicator on RCVR CONT unit extinguishes.
21	Set switch on MHSB CONT unit to AUTO position. **Requirement:** Preferred transmitter indicator on MHSB CONT unit should light.
22	Repeat this chart for Transmitter B/Receiver B.

TRANSMITTER _____ RECEIVER _____

TO

_____ _____

LOCATION LOCATION

FREQUENCY	INITIAL MEASUREMENT	SUBSEQUENT MEASUREMENTS			

TRANSMITTER _____ RECEIVER _____

TO

_____ _____

LOCATION LOCATION

FREQUENCY	INITIAL MEASUREMENT	SUBSEQUENT MEASUREMENTS			

Note: When test is completed, return this sheet to the end of Chart 5.

TRANSMITTER _____ RECEIVER _____

TO

_____ _____

LOCATION LOCATION

FREQUENCY	INITIAL MEASUREMENT	SUBSEQUENT MEASUREMENTS			

TRANSMITTER _____ RECEIVER _____

TO

_____ _____

LOCATION LOCATION

FREQUENCY	INITIAL MEASUREMENT	SUBSEQUENT MEASUREMENTS			

Note: When test is completed, return this sheet to the end of Chart 5.

CHART 6

TRANSMITTER ALARM CHECKS AND ADJUSTMENTS

The following test verifies proper operation of the transmitter AFC, pilot, and low power alarm functions. In a protected assembly, a transmitter is removed from service and the alarm conditions are simulated. Operation of the alarm circuits is checked and adjusted, if necessary, to ensure proper operation.

Caution: Do not operate test button on XMTR ALARM unit unless the transmitter is removed from service (protected assembly).

APPARATUS:

(None)

STEP	PROCEDURE

Note: The following procedure has been written for Transmitter A. For Transmitter B, perform the procedure and reverse all A and B references.

Preparation

1 Ensure that the alarm indicators on the XMTR ALM units are extinguished before proceeding.

2 Set switch on MHSB CONT unit to B ON TEST A position. (This frees Transmitter A for testing.)

Requirement: On MHSB CONT unit, MAN CONT indicator lights.

Alarm Check and Adjustment

Note: In the following procedure, the pilot alarm trigger point may be set incorrectly if the TEST button on the XMTR ALM unit is not depressed and released in the correct sequence. Ensure that the TEST button is only operated as given in the procedure.

3 Push and hold the TEST button on Transmitter A XMTR ALM unit.

Requirement: PLT, AFC, and PWR OUT indicators on XMTR ALM unit should light.

If the AFC indicator does not light, no adjustment is possible. Replace the XMTR ALM unit.

For PLT alarm adjustments, continue with Step 4; for PWR alarm adjustments, continue with Step 9.

CHART 6 (Cont)

STEP	PROCEDURE
4	If the PLT indicator is lit (TEST button depressed), continue with Step 5; if the PLT indicator is extinguished, continue with Step 6.
5	Adjust the PLT control on the XMTR ALM unit until the PLT indicator extinguishes.
6	Adjust the PLT control on the XMTR ALM unit until the PLT indicator just lights. Adjust the PLT control 1/2 turn in the opposite direction.
7	Release the TEST button on the XMTR ALM unit. Wait 30-45 seconds before continuing with Step 8.
8	Push and hold TEST button on XMTR ALM unit. Slowly adjust the PLT control until the PLT indicator just lights and an additional 1/8 turn past this point. Continue with Step 12.
9	If the PWR OUT indicator is lit (TEST button depressed), continue with Step 10; if the PWR OUT indicator is extinguished, continue with Step 11.
10	Adjust the PWR OUT control on the XMTR ALM unit until the PWR OUT indicator extinguishes. Release the TEST button.
11	Push and hold the TEST button and adjust the PWR OUT control 1/8 turn past the point that the PWR OUT indicator just lights.
12	Release TEST button. Wait 30-45 seconds before continuing with Step 13.
13	Repeat Step 3. If the requirement is met, continue with Step 14.
	Restoral Procedure
14	Verify that alarm indicators on both XMTR ALM units are extinguished.
15	Set switch on MHSB CONT unit to AUTO position.
	Requirement: MAN CONT indicator on MHSB LOGIC unit extinguishes.
16	Repeat this chart for Transmitter B.

CHART 7

MONITORED HOT STANDBY LOGIC CHECKS

This chart describes the procedure for checking the operation of the Monitored Hot Standby (MHS) Assembly. The assembly will determine which transmitter is connected to the antenna. This chart assumes that Transmitter A is preferred. If Transmitter B is preferred, reverse A and B references.

*Caution: **Both transmitters must be aligned (per Charts 3, 4, and 6) and operating normally before this check is started.***

APPARATUS:

(None)

STEP	PROCEDURE
1	Verify that the switch on the MHSB CONT unit is in AUTO and the switch on the RCVR CONT unit is in AUTO. Ensure that neither transmitter is in alarm. **Requirement:** Preferred transmitter indicator on MHSB CONT unit is lit. Alarm indicators on both XMTR ALM units are extinguished.
	XMTR A in Alarm
2	Simulate an alarm on Transmitter A by disconnecting power line leading to Transmitter A OSC MOD. **Requirement:** All alarm indicators on XMTR ALM unit light. On MHSB CONT unit, A ON indicator extinguishes and B ON indicator should light.
3	Reconnect power plug to OSC-MOD. **Requirement:** All alarm indicators on XMTR ALM unit extinguish and transmitter indicators on MHSB CONT revert to the state that existed before the power was disconnected. If AFC alarm does not clear, flip AFC switch off and then back on.
4	Repeat Steps 2 and 3 for Transmitter B.

CHART 8

RECEIVE PILOT ALARM CHECK AND ADJUSTMENT

The following procedure is a check of the receive pilot alarm circuit operation. This check simulates a drop in pilot signal. If the alarm fails to function, an adjustment is made to set the alarm at the correct trigger point.

CHART 8 (Cont)

APPARATUS:

(None)

STEP	PROCEDURE

Note: The following procedure has been written for Receiver A. For Receiver B, perform the procedure and reverse all A and B references.

Preparation

1 Ensure that the distant transmitters are operating in a "no-alarm" condition.

2 Ensure that the alarm indicators on the RCVR ALM units are extinguished.

3 Set switch on RCVR CONT unit to B ON TEST A position. (This frees Receiver A for testing.)

Requirement: LOCK ALM indicator on RCVR CONT unit lights.

Pilot Alarm Check and Adjustment

4 On Receiver A RCVR ALM unit, push PLT TEST button.

Requirement: PLT indicator on RCVR ALM unit lights.

If the indicator does not light, the trigger point may be set incorrectly. Continue with Step 6.

If the indicator does light, the alarm circuit is functioning. Continue with Step 5 to verify that the alarm point is correct.

5 With the PLT TEST button depressed, adjust PLT control on RCVR ALM unit until indicator just extinguishes. Release PLT TEST button.

6 Push PLT TEST button and adjust PLT control 1/8 turn past the point that the PLT indicator just lights.

Note: Due to hysteresis in the alarm circuit, the PLT trigger must be adjusted going from no-alarm into an alarm. Therefore, the PLT TEST button must be released and depressed before each adjustment.

7 Release PLT TEST button and repeat Step 4. If the requirement is met, continue with Step 8.

Restoral Procedure

8 Verify that alarm indicators on both RCVR ALM units are extinguished.

CHART 8 (Cont)

STEP	PROCEDURE
9	Set switch on RCVR CONT unit to AUTO position. **Requirement:** LOCK ALM indicator on RCVR CONT unit extinguishes.
10	Repeat this chart for Receiver B.

CHART 9

GO/NO-GO NODAN ALARM CHECK AND BASEBAND RELAY CHECK

This test outlines a simple GO/NO-GO check of the NODAN and threshold extension circuits and also verifies that the relay in RCVR BB AMPL unit is functioning under command from the RCVR ALM and RCVR CONT units. The NODAN threshold is not measured but the threshold can be set precisely as outlined in Chart 10.

APPARATUS:

(None)

STEP	PROCEDURE
	Note: The following procedure has been written for Receiver A. For Receiver B, perform the procedure and reverse all A and B references.
	Preparation
1	Ensure that the alarm indicators on the RCVR ALM units are extinguished and that the switch on the RCVR CONT unit is in AUTO position.
2	Set meter panel switch to EXT and connect meter test lead to 100 μA on meter.
	Alarm Check
3	Disconnect one coaxial lead from the Receiver A IF FLTR EQL unit. **Requirement:** NODAN and PLT indicators on RCVR ALM unit for Receiver A light. TH EXT indicator on IF AMPL unit for Receiver A lights. If the requirement is not met, perform Chart 10.
4	Connect meter test lead to MUTED 0 μA test point on RCVR BB AMPL for Receiver A.

CHART 9 (Cont)

STEP	PROCEDURE
	Requirement: Meter indication of 0 μA. If the requirement is not met, the RCVR CONT unit is faulty. The relay drive circuit in the RCVR BB AMPL may also be faulty. **Restoral Procedure**
5	Disconnect meter test lead.
6	Reconnect the coaxial lead removed in Step 3. **Requirement:** NODAN and PLT indicators on RCVR ALM unit for Receiver A extinguish. TH EXT indicator on IF AMPL Unit for Receiver A should extinguish.
7	Repeat this chart for Receiver B.

CHART 10

NODAN ALARM THRESHOLD CHECK AND ADJUSTMENT

This test outlines an in-service procedure for check and adjusting, if necessary, the NODAN alarm threshold in the RCVR ALM unit.

APPARATUS:

1--RF Signal Generator (SIG GEN), Hewlett-Packard 8614A or equivalent

1--Selective Voltmeter (SVM), Cushman CE24 option M3 (capable of measuring system pilot and baseband), or equivalent

1--RF Power Meter (PWR M), Hewlett-Packard 432A e/w 478A Thermistor Mount with N-type connector, or equivalent

1--Coaxial Dummy Load (COAX LOAD), 50 ohms, 25 watts, Engelmann Microwave Corp. T350N

1--Patch Cord (BNC to BNC), Farinon 87-10146-25

1--Patch Cord (N to N), Farinon 87-10147-06

1--Adapter (N to SMA), Selectro SC50-672-6701-89

CHART 10 (Cont)

STEP	PROCEDURE
	Note 1: The following procedure has been written for Receiver A. For Receiver B, perform the procedure and reverse all A and B references.
	Note 2: The output level of the SIG GEN should be calibrated using the PWR M before performing the chart.
	Preparation
1	Ensure that the alarm indicators on the RCVR ALM units are extinguished.
2	Set the switch on the RCVR CONT to B ON TEST A.
	Requirement: LOCK ALM indicator on RCVR CONT should light.
3	Remove the Receiver A RF input cable from the RF output of the antenna coupling unit.
4	Connect a 75-ohm terminated SVM with a 3.1-kHz bandwidth to the TEST OUT -30 dBm jack on Receiver A RCVR BB AMPL unit using the BNC to BNC patch cord. Tune SVM to one of the following frequencies: 1248 kHz for 300-channel system, 1730 kHz for 480-channel systems, or 2438 kHz for 600-channel systems.
5	Connect SIG GEN (tuned to receive frequency and set to an output level of -43 dBm) to the cable removed from the antenna coupling unit in Step 3.
6	Set assembly meter switch to +EXT and connect meter test lead between 100 μA on meter and DISC ZERO test point on LIM DEMOD unit for Receiver A.
7	Slowly adjust fine tuning on SIG GEN until assembly meter indicates 0 ± 1 μA.
	AGC indication on meter panel switch in A AGC position should indicate close to full scale.
	Requirement: NODAN indicator on RCVR ALM unit and TH EXT indicator on IF AMPL for Receiver A extinguishes.
8	Disconnect meter test lead.
	NODAN Check and Adjustment
9	Slowly decrease SIG GEN output until NODAN indicator on RCVR ALM unit for Receiver A lights.
10	Observe SVM indication.
	Requirement: SVM indicates a 30 dB Signal/Noise Ratio (-61 dBm).

CHART 10 (Cont)

STEP	PROCEDURE

If the requirement is met, continue with Step 15. If the requirement is not met, continue with Step 11.

11 Set SIG GEN output for an SVM indication of -61 dBm.

12 Adjust NODAN control on RCVR ALM unit for Receiver A until NODAN indicator on RCVR ALM unit lights.

13 Increase SIG GEN output level to -43 dBm.

14 Repeat Steps 9 through 13 until NODAN operates as required.

RF Threshold Calculation

15 Calculate RF threshold from the formula given below:

RF threshold = SIG GEN otuput* (when SVM indicates -61 dBm) - loss of N to N patch cord*.

*Calibration of N to N patch cord and measurement of the SIG GEN output are recommended if the threshold setting is to be estimated with a high degree of accuracy.

Requirement: Threshold should occur at one of the following levels or better:

CH CAPACITY	DEVIATION	THRESHOLD AT RF PREAMPL INPUT
300	200 kHz RMS	-89 dBm
300	280 kHz RMS	-92 dBm
480	200 kHz RMS	-85 dBm
600	140 kHz RMS	-80 dBm

Note: To compute the antenna port threshold the following correction factors should be added to the threshold just measured:

TYPE OF RECEIVER	CORRECTION FACTOR
Space Diversity	1 dB
Common Antenna (Hybrid)	4.5 dB
Common Antenna (10 dB Splitter)	Receiver A: 2 dB Receiver B: 12 dB

CHART 10 (Cont)

STEP	PROCEDURE
	Note: If the threshold requirement is not met, Receiver A may not be quieting properly.
	Restoral Procedure
16	Disconnect test equipment.
17	Reconnect the coaxial lead removed from the antenna coupling unit.
18	Set switch on RCVR CONT unit to AUTO position.
	Requirement: LOCK ALM indicator on RCVR CONT extinguishes.
19	Repeat this chart for Receiver B.

CHART 11

RECEIVER ALM UNIT LOG AMPL CHECK AND RCVR CONT UNIT COMPARATOR CHECK

This chart is to be performed only when a RCVR ALM unit is replaced. This chart describes an in-service check of the log amplifier in each RCVR ALM unit and a comparator check for the RCVR CONT unit.

APPARATUS:

1--Oscillator (OSC), Hewlett-Packard 651B, Option 02 (equivalent must cover entire baseband frequency range)

1--Electronic Voltmeter (EVM), Hewlett-Packard 400EL or equivalent

1--Card Extender (EXTENDER), Farinon SD-83186

2--6 dB Pads (PAD), Narda 4774-6

1--Patch Cord (BNC to BNC), Farinon 87-10146-25

1--Adapter (BNC T), Hewlett-Packard 1250-0781, or equivalent

1--Termination (TERM 75 BNC), Farinon 87-11812-53

CHART 11 (Cont)

STEP	PROCEDURE

Note: Both receivers should be operating normally with no alarm present before the tests begin.

LOG AMPL Check Test Setup

1 Set OSC to a frequency of 2.5 MHz (300-channel system) or 4.3 MHz (480 or 600-channel system) and an output level of -77d B (-68 dBm). Connect OSC and EVM as shown in Fig. 1.

2 Set switch on RCVR CONT unit to B ON TEST A.

3 Disconnect coaxial cable from IN jack on Receiver A RCVR BB AMPL.

4 Loosen mounting screws on Receiver A RCVR ALM unit and remove the unit. Place unit on EXTENDER and insert EXTENDER and RCVR ALM unit into RCVR ALM unit mounting space.

5 Connect OSC to TEST IN jack on Receiver A RCVR ALM unit using BNC to BNC patch cord.

LOG AMPL Check and Adjustment

6 Set meter panel switch to -EXT and connect meter test lead between 100 μA jack on meter and LOG AMPL test point on Receiver A RCVR ALM.

7 Adjust fine tuning control on OSC for a minimum meter indication.

Requirement: 60 ± 2 μA indication on meter.

If requirement is met, continue with Step 9. If requirement is not met, continue with Step 8.

8 Adjust NOISE LEVEL control (R7) until the requirement is met. Adjust the control clockwise to raise the meter indication, or counterclockwise to lower the meter indication. If the requirement is still not met, place a new RCVR ALM unit on the EXTENDER and repeat Steps 1, 5, 6, and 7.

9 Increase the OSC output to -37 dB (-28 dBm) and observe meter indication at the LOG AMPL test point.

Requirement: 20 ± 2 μA indication on meter.

If the requirement is met and the requirement in Step 7 is also met, continue with Step 11. If the requirement is not met, continue with Step 10.

CHART 11 (Cont)

STEP	PROCEDURE
10	Adjust LOG SLOPE control (R42) until the requirement is met. Adjust the control clockwise to lower the meter indication, or counterclockwise to raise the meter indication. If the requirement is still not met, replace the RCVR ALM unit and repeat Steps 1 through 9. **Note:** The LOG AMPL and NOISE LEVEL controls interact with each other. If either control was adjusted, repeat Steps 1 through 10 until all requirements are met.
11	Disconnect meter test lead and OSC.
12	Remove EXTENDER and RCVR ALM unit. Insert the RCVR ALM unit back into its mounting position.
13	Reconnect coaxial cable to IN jack on Receiver A RCVR BB AMPL.
14	Repeat Steps 1 through 13 for Receiver B. Remember to reverse all A and B references. After the Receiver B checks, continue with Step 15.
	RCVR CONT Comparator Checks Test Setup
15	Perform Steps 1 through 14 prior to the following checks.
16	Set switch on RCVR CONT to AUTO.
17	Set meter panel switch to -EXT and connect meter test lead between 100 µA on meter and COMP A and COMP B test points on RCVR CONT unit.
18	Observe which receiver is in service (80 µA or greater on meter panel). If the RCVR CONT is operating in the combining mode (straps Q in place), both receivers should be in service; if the RCVR CONT is operating in the optimal selection mode (Q straps not in place), Receiver A or Receiver B is in service. Record the in-service conditions. **Note:** Due to noise differences between receivers, the receivers may not be combined. The following check will verify the combining process.
	RCVR CONT Comparator Checks **Note:** Steps 19 through 26 apply to radios equipped with an RF HYBRID, or to space diversity systems. For radios equipped with a 10 dB splitter, perform Steps 28 through 34.
19	Set switch on RCVR CONT unit to B ON TEST A.

CHART 11 (Cont)

STEP	PROCEDURE
20	Insert two 6 dB pads in series with flex cable from RF HYBRID to RCVR A front end assembly.
21	Connect meter test lead to COMP Aand then to COMP B test points on RCVR CONT, and observe meter indications. **Requirement:** COMP A: 0 µA; COMP B: 80 µA or greater. If the requirement is not met, replace RCVR CONT unit.
22	Remove the two 6 dB PADS from the Receiver A RF input cable and reconnect the cable to the HYBRID. Connect the meter test lead to COMP A and then to COMP B test points on RCVR CONT, and observe meter indications. **Requirement:** In service conditins recorded in Step 18.
23	Switch to A ON TEST B on RCVR CONT.
24	Insert two 6 dB PADS in series with flex cable from RF HYBRID to RCVR B front end assembly.
25	Connect meter test lead to COMP A and then to COMP B test points on RCVR CONT and observe meter indications. **Requirement:** COMP A: 80 µA or greater; COMP B: 0 µA.
26	Remove the two 6 dB PADS from the B side of the Receiver B RF input cable and reconnect the cable to the HYBRID. Connect the meter test lead to COMP A and then to COMP B test points on RCVR CONT, and observe meter indications. **Requirement:** In-service indications recorded in Step 18.
27	Return RCVR CONT switch to AUTO position. **Note:** Test is complete for a radio equipped with an RF HYBRID or for space diversity.
28	Disconnect Receiver A RF cable from RF SPLITTER.
30	Connect meter test lead to COMP A and then to COMP B test points on RCVR CONT and observe meter indications. **Requirement:** COMP A: 0 µA; COMP B: 80 µA or greater. If the requirement is not met, replace RCVR CONT.

CHART 11 (Cont)

STEP	PROCEDURE
31	Reconnect Receiver A RF cable to RF SPLITTER.
32	Connect meter test lead to COMP A and then to COMP B test points on RCVR CONT and observe meter indications. **Requirement:** COMP A: 80 µA or greater; COMP B: 0 µA. If the requirement is not met, replace RCVR CONT.
33	Repeat Steps 28 through 32 for Receiver B. Remember to reverse all A and B references.
34	Return RCVR CONT switch to AUTO. **Note:** Test is now complete for a radio with a 10 dB splitter.

CHART 12

SYSTEM PILOT CHECK AND ADJUSTMENT

This chart is an in-service check of the pilot oscillator level at a pilot-transmit terminal and a through-pilot terminal. An out-of-service check of the pilot-keying feature is also provided and should only be performed at the time of initial installation.

APPARATUS:

1--Selective Voltmeter (SVM), Cushman CE24 option M3 (capable of measuring system pilot and baseband), or equivalent

1--Patch Cord (BNC to BNC), Farinon 87-10146-25

STEP	PROCEDURE
	Test Preparation
1	At a pilot-transmit terminal, continue with Step 5; at a through-pilot terminal, continue with Step 2.
2	Disconnect coaxial cable connected to PLT IN jack on BB INTERFACE unit.

CHART 12 (Cont)

STEP	PROCEDURE
3	Remove PLT OSC unit from shelf, remove the U-link (on pc board) and establish strap option Y. (This will key the PLT OSC on when the unit is placed back in the shelf.
4	Install PLT OSC unit back into the shelf.
5	Connect 75-ohm terminated SVM to MON jack on PLT OSC unit using BNC to BNC patch cord.
6	Tune SVM to system pilot frequency.
	System Pilot Level
7	Observe SVM indication.
	Requirement: SVM indication at MON jack given in Factory Test Data.
	If the requirement is not met, adjust LEV ADJ control on PLT OSC to meet the requirement.
	Restoral Procedure
8	Disconnect SVM.
9	At a through-pilot terminal, remove PLT OSC unit from shelf, remove U-link (on pc board) and establish strap option X.
10	Install PLT OSC unit back into shelf and reconnect coaxial cable to PLT IN jack on BB INTERFACE unit.
	Note: At the time of initial installation, continue with Step 11.
	Pilot Oscillator Keying (Out-of-Service Check)
11	At a through-pilot assembly, set meter panel switch to +EXT position and connect meter test lead between 100 μA on meter and test point on PLT OSC unit.
	Requirement: 0 μA indication on meter (pilot oscillator keyed off).
12	Disconnect coaxial cable at IN jack on Receiver A and B RCVR BB AMPL, and observe assembly meter indication at PLT OSC test point. (The receivers associated with the PLT OSC are not in the same rack. Be sure that the correct receivers are selected.)
	Requirement 1: PLT indicator on RCVR ALM units light.

CHART 12 (Cont)

STEP	PROCEDURE
	Requirement 2: Meter indication for PLT OSC test point is greater than 40 µA (pilot oscillator keyed on).
13	Reconnect coaxial cable at IN jack on both RCVR BB AMPL units.
	Requirement 1: PLT indicator on RCVR ALM unit extinguishes.
	Requirement 2: Meter indication for PLT OSC test point is 0 µA.
14	Disconnect meter test lead.

CHART 13

BASEBAND FREQUENCY RESPONSE CHECKS (INITIAL ALIGNMENT ONLY)

This chart is an out-of-service procedure to set a baseband reference level and then measure overall baseband response during initial installation. Hop-to-hop response is checked over individual transmitter-receiver paths with an oscillator and selective voltmeter. A prerequisite for the following test is the completion of Chart 4.

Note: During initial installation, Chart 5 should not be performed until after this chart (13) has been completed. An EVM can be used in place of the SVM for measurements but the radio pilot must be defeated by removing coaxial cable at PLT IN jack on BB INTERFACE unit.

APPARATUS:

1--Oscillator(OSC), Hewlett-Packard 651B option 02 (75-ohm generator able to cover entire baseband frequency range and noise slot), or equivalent

1--Selective Voltmeter (SVM), Cushman CE24 option M3 (capable of measuring system pilot and baseband), or equivalent

1--Electronic Voltmeter (EVM), Hewlett-Packard 400EL or 400FL, or equivalent

1--Patch Cord (BNC to BNC), Farinon 87-10146-25

1--Adapter (BNC T), Hewlett-Packard 1250-0781

1--Termination (TERM 75 BNC), Farinon 87-11812-53

CHART 13 (Cont)

STEP	PROCEDURE

Note: The following procedure has been written for Transmitter A/Receiver A. For Transmitter B/Receiver B, perform the procedure and reverse all A and B references.

Transmit (Local) Terminal Setup

1 Verify that alarm indicators on XMTR ALM units are extinguished and the transmitters are operating normally.

2 Set switch on MHSB CONT unit to A ON TEST B position.

Requirement: A ON and MAN CONT indicators on MHSB CONT unit light.

3 Remove all coaxial cables connected to BB IN jacks on BB INTERFACE unit. (If EVM is to be used, disconnect coaxial cable at PLT IN jack on BB INTERFACE unit.)

4 Set OSC to a frequency of 100 kHz at an output level of -44 dB (-35 dBm). Connect OSC and EVM as shown in Fig. 1.

5 Connect OSC to -35 dBm IN jack on BB INTERFACE unit using BNC to BNC patch cord.

Caution: Disable PILOT OSC if EVM is being used.

Receive (Distant) Terminal Setup

6 Set switch on RCVR CONT unit to A ON TEST B position.

Requirement: LOCK ALM indicator on RCVR CONT unit lights.

7 Remove all coaxial cables connected to BB OUT jacks on BB INTERFACE unit.

8 Connect 75-ohm terminated SVM to -15 dBm BB OUT jack on BB INTERFACE unit and tune SVM to 100 kHz.

Reference Level Check and Adjustment

9 Observe SVM indication.

Requirement: SVM indication of -15 dBm (-24 dB if EVM is used).

If the requirement is not met, adjust LEV ADJ control on Receiver A RCVR BB AMPL unit to meet the requirement.

CHART 13 (Cont)

STEP	PROCEDURE
	Baseband Frequency Response
10	Tune OSC at transmit (local) terminal and SVM at receive (distant) terminal, one frequency at a time, to the frequencies given in the Factory Test Data. Recheck OSC output level each time to ensure it remains at -44 dB (-35 dBm).
11	Each time, observe indication on distant SVM (EVM). **Requirement:** SVM indication of -15 dBm (-24 dB if EVM is used) ± 0.25 dB, 4 kHz to top BB frequency ± 1.5 dB, 0.3 to 4 kHz.
12	Repeat Steps 1 through 11 for Transmitter B/Receiver B, and then continue with Step 13.
	Restoral Procedure
13	Remove OSC and SVM and reconnect all normal cabling on the transmit and receive BB INTERFACE units.
14	At the receive (distant) terminal, set switch on RCVR CONT unit to AUTO position. **Requirement:** LOCK ALM indicator on RCVR CONT unit extinguishes.
15	At a transmit (local) terminal, set switch on MHSB CONT unit to AUTO position. **Requirement:** A ON indicator on MHSB CONT unit remains lit. MAN CONT indicator extinguishes.

CHART 14

NOISE LOADING TESTS

This chart outlines noise loading procedures that will test a Farinon FL1-2 Microwave Radio System for intermodulation distortion and idle noise. The radio system must be removed from service to perform hop-to-hop noise loading tests on a single transmitter/receiver path.

Previous tests given in the alignment procedures have checked specific functions of the radio (e.g., alarm circuits deviation, frequency response, etc.). A noise loading test, however, is designed to test the traffic carrying capabilities of the complete radio through use of a white noise test signal that closely resembles the complex baseband information the radio is intended to carry.

CHART 14 (Cont)

The test setup requires a noise generator and a noise receiver. The noise generator signal is applied to the transmitters at a bandwidth determined by the channel capacity of the radio system and at a loading level that has been determined through statistical tests of similar radios under actual traffic conditions. The noise receiver is connected to the receiver baseband output and will measure low signal and noise levels at specific points in the baseband.

After the test equipment has warmed up, the noise generator and noise receiver are connected to the radio equipment. The noise generator output level is set and the noise receiver is calibrated to measure in three slots.

Idle noise is measured in each of the three 3.1-kHz slots of the noise receiver. The noise generator is removed from the transmitter input during this part of the test and the input is terminated.

Loaded noise is measured by reconnecting the noise generator to the transmitter and inserting bandstop filters in the noise generator signal. The noise receiver is then used to measure the noise plus distortion in the empty channel created by each bandstop filter.

Both idle and loaded noise measurements are then compared with system specifications. If the requirements are met, the transmitter/receiver path is restored to service within the system. If the requirements cannot be met on initial installation, engineering personnel should be consulted.

Several units of measurement are used to express loaded noise performance of a radio system. The most common is NOISE POWER RATIO (NPR) which expresses the difference in dB between the noise appearing in a measuirng slot when there is no bandstop filter inserted in the noise generator and the noise remaining after the bandstop filter is inserted. Another common unit is a flat weighted signal-to-noise ratio (S/N). It is also a dB ratio based on the difference between the reference test tone level of the radio and the level of the noise appearing in the measurement slot with a bandstop filter inserted at the noise generator. Conversion factors between NPR and flat S/N are given below for different channel loadings:

To convert NPR to flat S/N add 16.2 dB (300 channels), 16.1 dB (480 channels), or 16.4 dB (600 channels).

Noise levels equivalent to those measured with F1A or C-message weighting networks can be obtained from the flat S/N ratio by using the formulas below:

F1A weighted noise in dBa0 = 82 - flat S/N.
C-message weighted noise in dBrnc0 = 88.5 - flat S/N.

The procedure that follows assumes that maintenance personnel are familiar with noise loading procedures. The wide variety of test equipment available requires a general set of instructions designed to supplement the procedures given in the manufacturer's test equipment manuals. Refer to the manual provided with your test equipment for specific instructions on test equipment setup, calibration, and operation of controls.

CHART 14 (Cont)

APPARATUS:

1--Noise Loading Test Set

1--Termination (TERM 75 BNC), Farinon 87-11812-53

1--Filter (FLT), Farinon SD-19797-35 (required for noise loading 480 channel systems)

STEP	PROCEDURE

Note: Allow one-half hour for noise loading equipment to warm up. The radio system must be operating hop-to-hop in a normal (no alarm) condition).

Sending Terminal Setup

Note: Designate one end of the radio link as sending terminal and perform the following steps.

1 Remove coaxial cables on all BB IN jacks on BB INTERFACE unit.

Caution: Noise level and bandwidth of noise generator should be set before connecting to transmitter to avoid over-deviation.

2 Connect noise generator to -35 dBm IN jack on BB INTERFACE unit. Insert HIGH PASS and LOW PASS filters in the noise generator and set the output for the WIDEBAND NOISE LOADING LEVEL specified on pull-out data sheet at the end of this chart. (The WIDEBAND NOISE LOADING LEVEL is referenced to the -35 dBm BB IN level.)

Refer to manufacturer's manual for cable connections.

3 Set MHSB CONT switch to A ON TEST B.

Requirement: MHSB CONT, LOCK ALM, and A IN SERVICE indicators light.

Receiving Terminal Setup

Note: Designate the other end of the radio link as receiving terminal and perform the following steps.

4 Set switch on RCVR CONT unit to A ON TEST B position.

Requirement: LOCK ALM indicator on RCVR CONT unit lights.

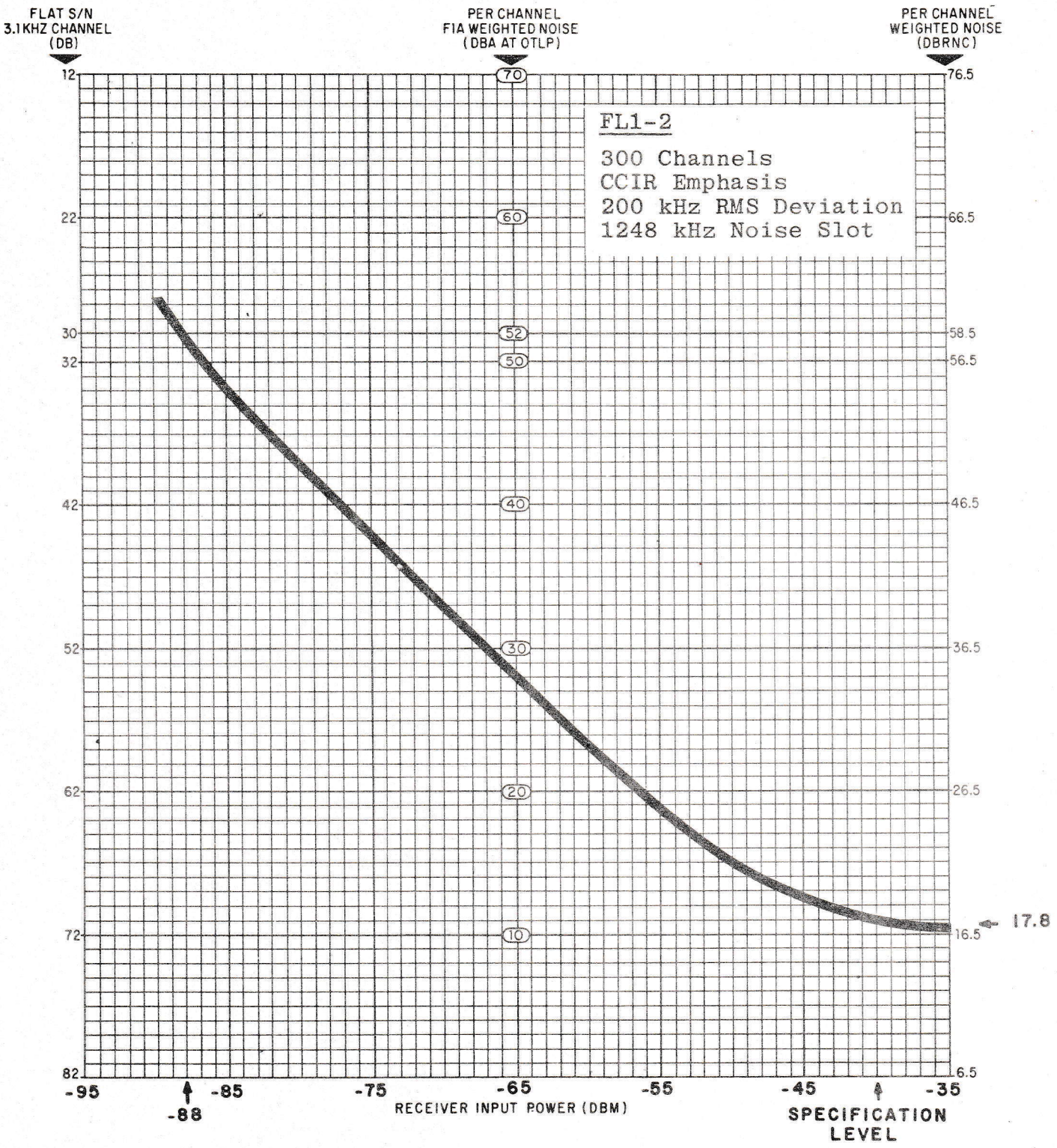
5 Remove coaxial cables on all BB OUT jacks on BB INTERFACE unit.

CHART 14 (Cont)

STEP	PROCEDURE
	Noise Measurements
6	At receiving terminal, calibrate noise receiver as directed in test equipment manual.
7	At sending terminal, disconnect noise generator from -35 dBm IN jack and connect TERM 75 BNC termination.
8	At receiving terminal, measure the idle noise levels in the 3 NOISE SLOTS of the Noise Receiver. Record the measurements. (The NOISE SLOTS are specified in the pull-out data sheet. Noise receiver measurements are made as specified in test equipment manual.)
9	At sending terminal, reconnect noise generator to -35 dBm IN jack and switch to LOW SLOT bandstop filter. (Refer to pull-out data sheet.)
10	At receiving terminal, measure noise and distortion level in LOW SLOT with noise generator. Record the measurement.
11	Repeat Steps 9 and 10 for MID SLOT and TOP SLOT.
12	Convert idle noise and loaded noise measurements to dBa0 or dBrnc0 as described in the introduction of this chart. Record measurements for later comparison.
13	Set switches on RCVR CONT and MHSB CONT units to B ON TEST A position. Repeat Steps 6 through 12 and then continue with Step 14.
	Interpretation of Noise Measurements
14	Compare results of receivers to requirements on pull-out data sheet. If the requirements are not met, continue with Step 15; if the requirements are met, continue with Step 20.
	Note: RF input to receiver under test is an important factor in noise level requirements. The RF input is estimated by setting assembly meter switch to AGC position and converting meter indication to equivalent RF by using the AGC vs. RF INPUT graph in Factory Test Data.
15	Both receivers could test out with excessive noise. This is due to noise produced by antenna coupling unit components.
16	If one receiver appears noisy, continue with Step 17.
17	If both idle and loaded noise are excessive, check the receiver input. (Idle noise is the controlling factor.)

CHART 14 (Cont)

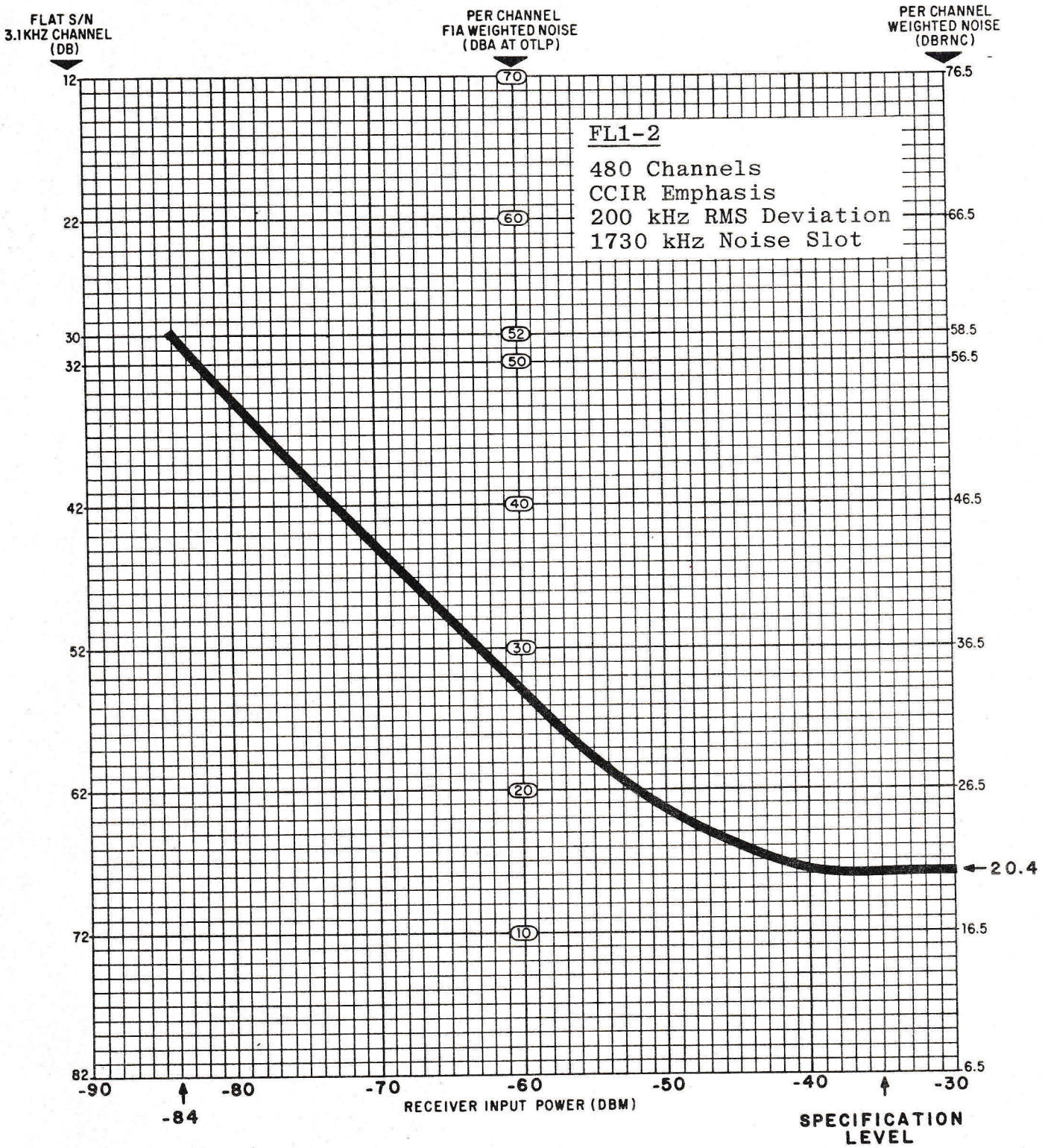
STEP	PROCEDURE
18	High loaded noise in LOW SLOT is an indication of problems in modulator and demodulator, baseband amplifier or power supply sections. LIN ADJ control on LIMITER-DEMOD can be adjusted to minimize intermodulation distortion in LOW SLOT. *Caution: **LIN ADJ control interacts with other controls. Care should be taken to maintain discriminator zero setting and baseband output level.***
19	High loaded noise in TOP SLOT is an indication of problems in Receiver, front end, IF amplifiers and IF filter, antenna waveguide run or multipath distortion. L5 on IF FLT/EQL can be adjusted for minimum distortion in TOP SLOT. ***Caution: Adjustment of TOP SLOT also has large affect on noise level in MID SLOT.***
20	If high loaded noise is present in all slots, or only in middle slot, check for antenna damage, problems in waveguide, and multipath distortion.
	Restoral Procedure
21	Disconnect noise generator and noise receiver at each terminal and reconnect normal cabling to BB IN and BB OUT jcks on BB INTERFACE unit.
22	Set switch on RCVR CONT unit at receiving terminal to AUTO position. **Requirement:** LOCK ALM indicator on RCVR CONT unit extinguishes.
23	Set MHSB CONT switch to AUTO. **Requirement:** LOCK ALM indicator extinguishes; preferred transmitter indicator lights.
24	Entire chart should be performed in opposite direction to complete Noise Loading Test of entire hop path.


FLAT S/N
3.1 KHZ CHANNEL
(DB)
PER CHANNEL
F1A WEIGHTED NOISE
(DBA AT OTLP)
PER CHANNEL
WEIGHTED NOISE
(DBRNC)
FL1-2
300 Channels
CCIR Emphasis
200 kHz RMS Deviation
1248 kHz Noise Slot
12
22
30
32
42
52
62
72
82
70
60
52
50
40
30
20
10
76.5
66.5
58.5
56.5
46.5
36.5
26.5
16.5
6.5
17.8
-95
-88
-85
-75
-65
-55
-45
-35
RECEIVER INPUT POWER (DBM)
SPECIFICATION
LEVEL

NOISE LOADING TEST DATA

300 CHANNELS

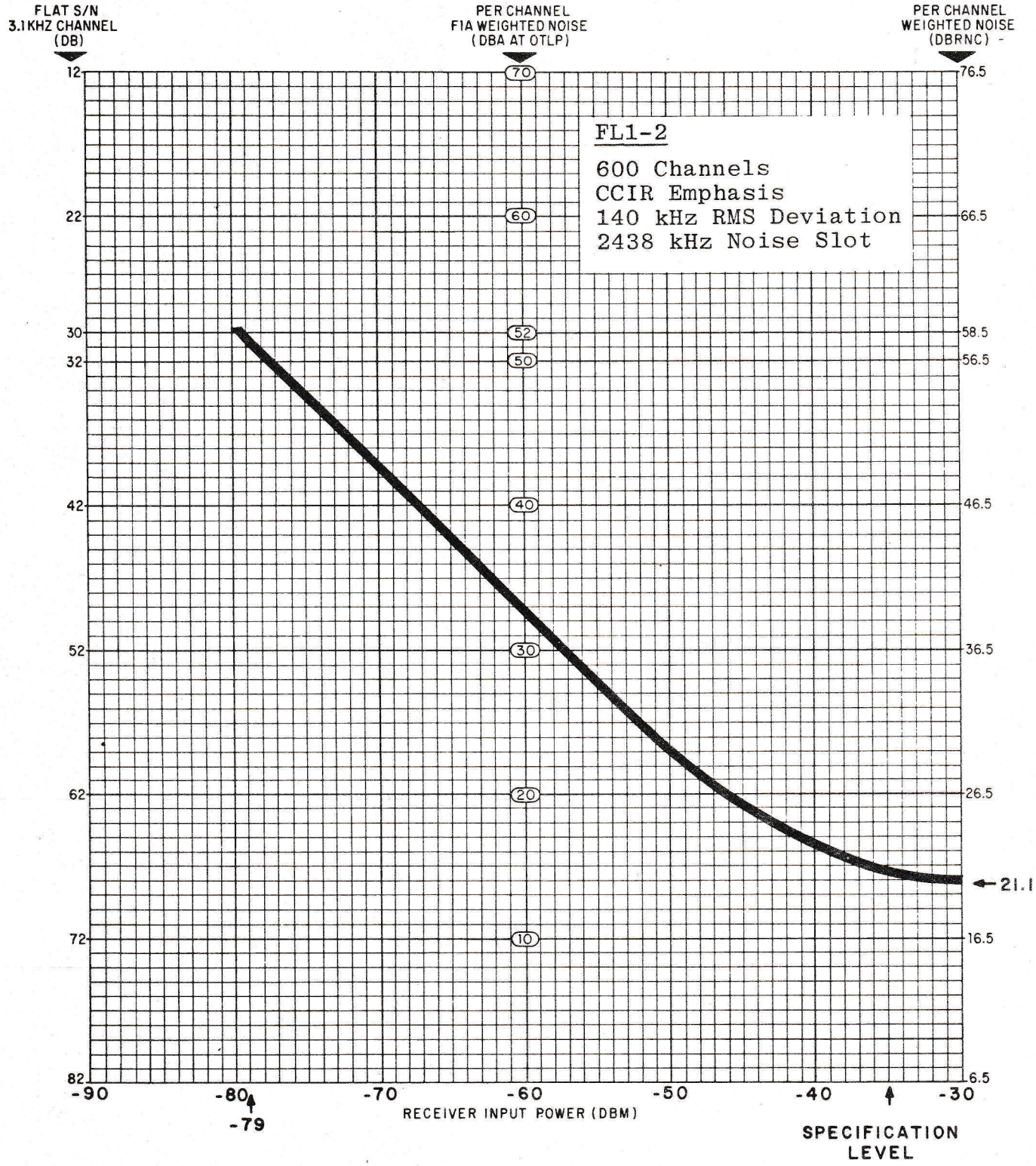
WIDEBAND NOISE LOADING LEVEL:		+9.8 dBm0
NOISE SLOT POSITIONS	LOW SLOT	70 kHz
	MID SLOT	534 kHz
	TOP SLOT	1248 kHz
BANDWIDTH SELECT FILTERS	HIGH PASS	60 kHz
	LOW PASS	1296 kHz
LOADED NOISE MEASUREMENT	Equal to or less than 17.8 dBrnc0 for an RF input level of -40 dBm.	
IDLE NOISE REQUIREMENT:	See graph to the left.	
AGC vs. RF INPUT GRAPH:	See Factory Test Record.	


FLAT S/N
3.1KHZ CHANNEL
(DB)
PER CHANNEL
F1A WEIGHTED NOISE
(DBA AT OTLP)
PER CHANNEL
WEIGHTED NOISE
(DBRNC)
FL1-2
480 Channels
CCIR Emphasis
200 kHz RMS Deviation
1730 kHz Noise Slot
12
22
30
32
42
52
62
72
82
70
60
52
50
40
30
20
10
76.5
66.5
58.5
56.5
46.5
36.5
26.5
16.5
6.5
20.4
-90
-80
-70
-60
-50
-40
-30
-84
RECEIVER INPUT POWER (DBM)
SPECIFICATION
LEVEL

NOISE LOADING TEST DATA

480 CHANNELS

WIDEBAND NOISE LOADING LEVEL:		+11.8 dBm0
NOISE SLOT POSITIONS	LOW SLOT	70 kHz
	MID SLOT	534 kHz
	TOP SLOT	1730 kHz
BANDWIDTH SELECT FILTERS	HIGH PASS	60 kHz
	LOW PASS	1998 kHz
LOADED NOISE MEASUREMENT	Equal to or less than 20.4 dBrnc0 for an RF input level of -35 dBm.	
IDLE NOISE REQUIREMENT:	See graph to the left.	
AGC vs. RF INPUT GRAPH:	See Factory Test Record.	


FLAT S/N
3.1KHZ CHANNEL
(DB)
PER CHANNEL
F1A WEIGHTED NOISE
(DBA AT OTLP)
PER CHANNEL
WEIGHTED NOISE
(DBRNC)
FL1-2
600 Channels
CCIR Emphasis
140 kHz RMS Deviation
2438 kHz Noise Slot
12
22
30
32
42
52
62
72
82
70
60
52
50
40
30
20
10
76.5
66.5
58.5
56.5
46.5
36.5
26.5
16.5
6.5
21.1
-90
-80
-70
-60
-50
-40
-30
-79
RECEIVER INPUT POWER (DBM)
SPECIFICATION
LEVEL

NOISE LOADING TEST DATA

600 CHANNELS

WIDEBAND NOISE LOADING LEVEL:		+12.8 dBm0
NOISE SLOT POSITIONS	LOW SLOT	70 kHz
	MID SLOT	1248 kHz
	TOP SLOT	2438 kHz
BANDWIDTH SELECT FILTERS	HIGH PASS	60 kHz
	LOW PASS	2600 kHz
LOADED NOISE MEASUREMENT	Equal to or less than 21.1 dBrnc0 for an RF input level of -34 dBm.	
IDLE NOISE REQUIREMENT:	See graph to the left.	
AGC vs. RF INPUT GRAPH:	See Factory Test Record.	

Table A

Recommended Test Equipment List

APPARATUS:

1--Oscillator (OSC), Hewlett-Packard 651B, Option 2, (equivalent must cover baseband frequency range)

1--RF Power Meter (PWR M), Hewlett-Packard 432A e/w 478A Thermistor Mount with N-type connector, or equivalent

1--RF Signal Generator (SIG GEN), Hewlett-Packard 8614A, or equivalent

1--Electronic Voltmeter (EVM), Hewlett-Packard 400EL, or equivalent

1--Frequency Selective Voltmeter (SVM), Cushman CE24 Option M3 (capable of measuring system pilot and baseband), or equivalent

1--Baseband Calibrator (CALIB), Farinon 80402

1--Volt-Ohm Meter (VOM), 20,000/volt, Triplett 630NA, or equivalent

1--Electronic Counter (COUNTER), Hewlett-Packard 5245L with Frequency Converter, Hewlett-Packard 5254C, or equivalent

1--Digital Multimeter (DMM), Fluke 8000A, or equivalent

1--Card Extender (EXTENDER), Farinon 83186

2--6 dB Pad (PADS), Narda 4774-6

1--Coaxial Dummy Load (COAX LOAD), 50 ohms, 25 watts, Engelmann Microwave Corp. T350N

1--Noise Loading Test Set

1--Filter, Lowpass, Farinon SD-19797-35 (required for noise loading 480-channel systems)

1--Patch Cord (BNC to BNC), BNC male to BNC male, Farinon 87-10146-25

1--Patch Cord (SMA to SMA), SMA male to SMA male, Farinon 87-10147-10

1--Right Angle Adapter (N to SMA), N female to SMA male, Farinon 87-19930-14

1--Adapter (SMA to N), SMA female to N male, Farinon 87-11812-55

1--Adapter (N to SMA), N female to SMA female, Selectro SC50-622-6701-89

1--Adapter (BNC T), 2 female to 1 male, Hewlett-Packard 1250-0781

1--Termination (TERM 75 BNC), 75 ohm BNC male, Farinon 87-11812-53

1--Coaxial Attenuator (ATTEN), 30 dB, 50 ohms, Narda 766-30

REPLACEMENT PROCEDURE

FARINON TYPE FL1-2

MICROWAVE RADIO SYSTEM

GENERAL

This replacement procedure (RP) describes the method of removing and replacing units in a Farinon Type FL1-2 radio. Most unit replacements consist of removing the faulty unit and replacing it with a spare (same option number and strapping arrangements) which is then realigned, if necessary.

CHART **PAGE**

CHART 1

PILOT OSCILLATOR

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Disconnect coaxial cable at OUT jack on PLT OSC.
2	Loosen two mounting screws on PLT OSC and remove unit.
	UNIT REPLACEMENT
3	Verify that option number of new PLT OSC unit is the same as the old unit.
4	Ensure that the link on the circuit board is in the Y position.
	Note: The link is in the Y position until ALIGNMENT is completed.
5	Install new unit, tighten mounting screws, and reconnect cable to OUT jack.
	ALIGNMENT
6	Perform System Pilot Check and Adjustment chart in AP.

CHART 2

TRANSMITTER BASEBAND AMPLIFIER

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Disconnect coaxial cables at J1 HIGH IMP and OUT jacks on XMTR BB AMPL.
2	Loosen two mounting screws on the front of the XMTR BB AMPL and remove the unit.
	UNIT REPLACEMENT
3	Verify that the option number of the new XMTR BB AMPL corresponds to the old unit.
4	Install the new unit and tighten the two mounting screws.
5	Reconnect the coaxial cables to the J1 HIGH IMP and OUT jacks on XMTR BB AMPL.
	ALIGNMENT
6	Perform Receiver Calibration/Transmitter Deviation Check and Adjustment chart in AP.
7	Perform Baseband Frequency Response: Test Record and Subsequent Checks chart in AP.

CHART 3

OSCILLATOR-MODULATOR

APPARATUS:

(None)

STEP	PROCEDURE

Warning: Lock the other transmitter on air before proceeding.

CHART 3 (Cont)

STEP	PROCEDURE
	UNIT REMOVAL
1	Switch the power off.
2	Slide the transmitter assembly forward.
3	Disconnect all connections to the OSC-MOD.
4	Remove the four screws on the back plate that hold the OSC-MOD.
	UNIT REPLACEMENT
5	Verify that the option number and frequency of the new OSC-MOD corresponds to the old OSC-MOD.
6	Install the new unit and tighten the mounting screws.
7	Replace all connections to the OSC-MOD.
8	Slide the transmitter assembly back into place.
9	Switch the power on.
	ALIGNMENT
10	Turn on the AFC.
	Requirement: AFC alarm clears.
	If requirement is not met, perform all transmitter checks in AP.
	If requirement is still not met, replace the OSC-MOD.
11	Perform Transmitter Frequency Check and Adjustment, Receiver Calibration/Transmitter Deviation Check and Adjustment, and Transmitter Alarm Checks and Adjustments charts in AP.

CHART 4

TRANSMITTER AFC

APPARATUS:

(None)

CHART 4 (Cont)

STEP	PROCEDURE
	UNIT REMOVAL
1	Turn transmitter power off.
2	Slide transmitter assembly forward.
3	Disconnect all external connections to the transmitter assembly.
4	Remove transmitter from radio.
5	Disconnect all external connections to the AFC unit.
6	Remove the two screws that hold the cable harness, and the two screws directly above at the top of the unit. Remove the unit.
7	Perform this step only if the XMTR LO unit is being replaced. If the AFC unit is being replaced, go to Step 9. A new REF OSC crystal is supplied with the new XMTR LO. Unplug the old REF OSC crystal from the AFC unit and plug in the new one.
8	Go to Step 10.
9	If the REF OSC crystals in both the old and new AFC units have the same offset frequency, go to Step 10. If the offset values differ, plug the old REF OSC crystal into the new AFC unit. **Note:** The old crystal is used in order to ensure that the AFC unit has the proper offset from the XMTR LO.
	UNIT REPLACEMENT
10	Verify that the option number of the new unit is the same as the option number of the old unit.
11	Using the four screws removed in Step 6, reinstall the AFC unit on the frame.
12	Reconnect all external connections to the AFC unit.
13	Place the transmitter back in the frame.
14	Reconnect all external connections to the transmitter assembly.
15	Slide the transmitter assembly to the rear of the frame.
16	Turn the power on.
	ALIGNMENT
17	Perform the Transmitter Frequency and Adjustment chart in the AP.

CHART 4 (Cont)

STEP	PROCEDURE
18	Set the assembly meter switch to -EXT and connect meter test lead between 100 μA on meter and the DISC (blue) on the AFC unit. **Requirement:** 15 ±1 divisions. If the requirement is not met, adjust PLT DISC control on the AFC unit to meet the requirement.

CHART 5

TRANSMITTER ALARM UNIT

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Loosen two mounting screws on the front of the XMTR ALM unit, and remove unit.
	UNIT REPLACEMENT
2	Verify option number of the new XMTR ALM unit is the same as the old unit.
3	Verify that the X or Y strap of the new XMTR ALM unit is the same as the old unit.
4	Install unit and tighten screws.
	ALIGNMENT
5	Perform Transmitter Alarm Check and Adjustment chart in AP.

CHART 6

RECEIVER BASEBAND AMPLIFIER

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Disconnect coaxial cables from IN and J3 LOW IMP jacks of RCVR BB AMPL.
2	Loosen two mounting screws on front of RCVR BB AMPL and remove unit.
	UNIT REPLACEMENT
3	Verify that option number of new RCVR BB AMPL is the same as the old unit.
4	Install the new unit and tighten mounting screws.
5	Reconnect coaxial cables to IN and J3 LOW IMP jacks of RCVR BB AMPL.
	ALIGNMENT
6	Perform only the receiver calibration section in Receiver Calibration/Transmitter Deviation Check and Adjustment chart in AP.
7	Perform Baseband Frequency Response: Test Record and Subsequent Check chart in AP.
8	Perform GO/NO-GO NODAN Alarm and Baseband Relay Check chart in AP.

CHART 7

RECEIVER ALARM UNIT

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Loosen two mounting screws on front of RCVR ALM and remove unit.

CHART 7 (Cont)

STEP	PROCEDURE
	UNIT REPLACEMENT
2	Verify that the option number of the new RCVR ALM unit is the same as the old unit.
3	Verify that the strapping options of the new RCVR ALM unit are the same as the old unit.
4	For non-protected assemblies, verify that the strapping options for BB relay drive logic voltages and PLT/NODAN mute option of the new RCVR ALM unit are the same as the old unit.
5	Install new unit and tighten mounting screws.
	ALIGNMENT
6	Perform Receive Pilot Alarm Check and Adjustment chart in AP.
7	Perform NODAN Alarm Threshold Check and Adjustment chart in AP.
8	Perform RCVR ALM unit LOG AMPL Check and RCVR CONT Unit Comparator Check in AP.

CHART 8

LIMITER DEMODULATOR

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Disconnect coaxial cables at IN and OUT jacks on LIM DEMOD unit.
2	Loosen two mounting screws on front of unit and remove unit.
	UNIT REPLACEMENT
3	Install new unit and tighten two mounting screws.

CHART 8 (Cont)

STEP	PROCEDURE
4	Reconnect coaxial cables to IN and OUT jacks on LIM DEMOD unit.
	ALIGNMENT
5	Perform only receiver calibration section in Receiver Calibration/Transmitter Deviation Check and Adjustment chart in AP. Do not adjust deviation of transmitter.
6	Perform Baseband Frequency Response: Test Record and Subsequent Checks chart in AP.
7	Perform Noise Loading Tests chart in AP to optimize the LOW SLOT (LIN ADJ control on LIM DEMOD).

CHART 9

IF AMPLIFIER

APPARATUS:

1--RF Signal Generator (SIG GEN), Hewlett-Packard 8614A, or equivalent

1--Electronic Counter (COUNTER), Hewlett-Packard 5245L with Frequency Converter, Hewlett-Packard 5254C, or equivalent

1--Coaxial Dummy Load (COAX LOAD), 50 ohms, 25 watts, Engelmann Microwave Corp. T350N

1--Card Extender (EXTENDER), Farinon 83186

1--Patch Cord (N to N), Farinon 87-10147-06

1--Patch Cord (BNC to BNC), Farinon 87-10146-25

1--Adapter (N to SMA), Selectro SC50-622-6701-89

STEP	PROCEDURE
	UNIT REMOVAL
1	Disconnect coaxial cables from IN and OUT jacks on IF AMPL unit.

CHART 9 (Cont)

STEP	PROCEDURE
2	Loosen two mounting screws on front of unit and remove unit.
	UNIT REPLACEMENT
3	Install new IF AMPL unit on EXTENDER and install EXTENDER in IF AMPL position. Set MGC/AGC switch on IF AMPL to AGC.
4	Connect coaxial cables (supplied with extender) between IN jack on IF AMPL and OUT jack on IF FLT EQL, and between OUT jack on IF AMPL and IN jack on LIM DEMOD.
	AGC CALIBRATION PROCEDURE
5	Disconnect the flexible cable connected to the receiver front end assembly from the antenna coupling unit. (That is, leave cable connected to receiver input.)
6	Using correction factor listed in Step 10, adjust SIG GEN to receiver frequency and an output level at the antenna port of -40 dBm.
7	Connect SIG GEN to the cable disconnected in Step 5. Use N to N patch cord and N to SMA adapter. Set the SIG GEN frequency precisely to channel frequency by measuring at a 70-MHz IF point by one of the following methods. (a) Connect COUNTER to MON jack on IF AMPL unit using BNC to BNC patch cord. Adjust SIG GEN frequency for an indication 70 MHz on COUNTER. (b) Set meter panel switch to +EXT and connect meter test lead between 100 µA on meter and DISC ZERO test point on LIM DEMOD unit. Adjust SIG GEN frequency for a meter panel indication of 0 ± 1 µA. The first method is the preferred method for setting 70 MHz.
8	Set meter panel switch to AGC for the receiver in question and observe meter indication. **Requirement:** 95 ± 3 µA. If the requirement is not met, adjust FULL SCALE ADJ control to meet the requirement.
9	Disconnect power connector on RCVR LO for receiver in question and observe meter indication (AGC). **Requirement:** 0 ± 2 µA. If the requirement is not met, adjust ZERO ADJ control to meet the requirement.

CHART 9 (Cont)

STEP	PROCEDURE

10 Reconnect power connector on RCVR LO.

Note: In order to produce an AGC curve (see Fig. 1 at the end of this chart) which is correctly calibrated, a correction factor representing the attenuation between the antenna port and the point where the signal generator is connected must be added to the SIG GEN level. For example, if the correction factor is 5 dB (3.5 dB hybrid) and the SIG GEN level is -35 dBm, the corresponding antenna port level is -35, +5 = -30 dBm. The correction factors for the various receiver configurations are shown below.

Receiver Type	Correction Factor
Non-Protected/ Space Diversity "A"	1 dB
Space Diversity "B"	0 dB
3.5 dB Hybrid "A" & "B"	5 dB
RF Splitter "A"	2 dB
RF Splitter "B"	12 dB

11 Using the appropriate correction factor from Step 10, adjust the signal generator to correspond to an antenna port level of -30 dBm.

12 Decrease the SIG GEN output level in 5-dB steps and record each AGC meter indication on RECEIVER AGC CURVE.

THRESHOLD EXTENSION CHECK AND ADJUSTMENT

13 Adjust SIG GEN output level to correspond to an antenna port level of -50 dBm.

14 Decrease SIG GEN output level until TH EXT indicator on IF AMPL unit just lights.

Requirement: TH EXT indicator should light within ± 2 dBm of the level given in the Factory Test Data.

If the requirement is not met, continue with Step 15.

If the requirement is met, continue with Step 18.

15 Adjust SIG GEN output level to correspond to an antenna port level the same as the receiver threshold extension level given in the Factory Test Data.

16 Adjust TH EXT control on IF AMPL unit until the TH EXT Indicator is lit.

CHART 9 (Cont)

STEP	PROCEDURE
17	Repeat Steps 13 and 14 until the requirement in Step 14 is met.
	RESTORAL PROCEDURE
18	Disconnect test equipment. Remove coaxial cable connected to IF AMPL unit and remove EXTENDER and IF AMPL unit.
19	Remove IF AMPL unit from EXTENDER and install IF AMPL unit in rack.
20	Reconnect normal cabling to IN and OUT jacks on IF AMPL unit and associated units.
21	Reconnect coaxial cable removed in Step 5.
22	Verify that alarm indicators on RCVR ALM units are extinguished.

Receiver AGC Curve

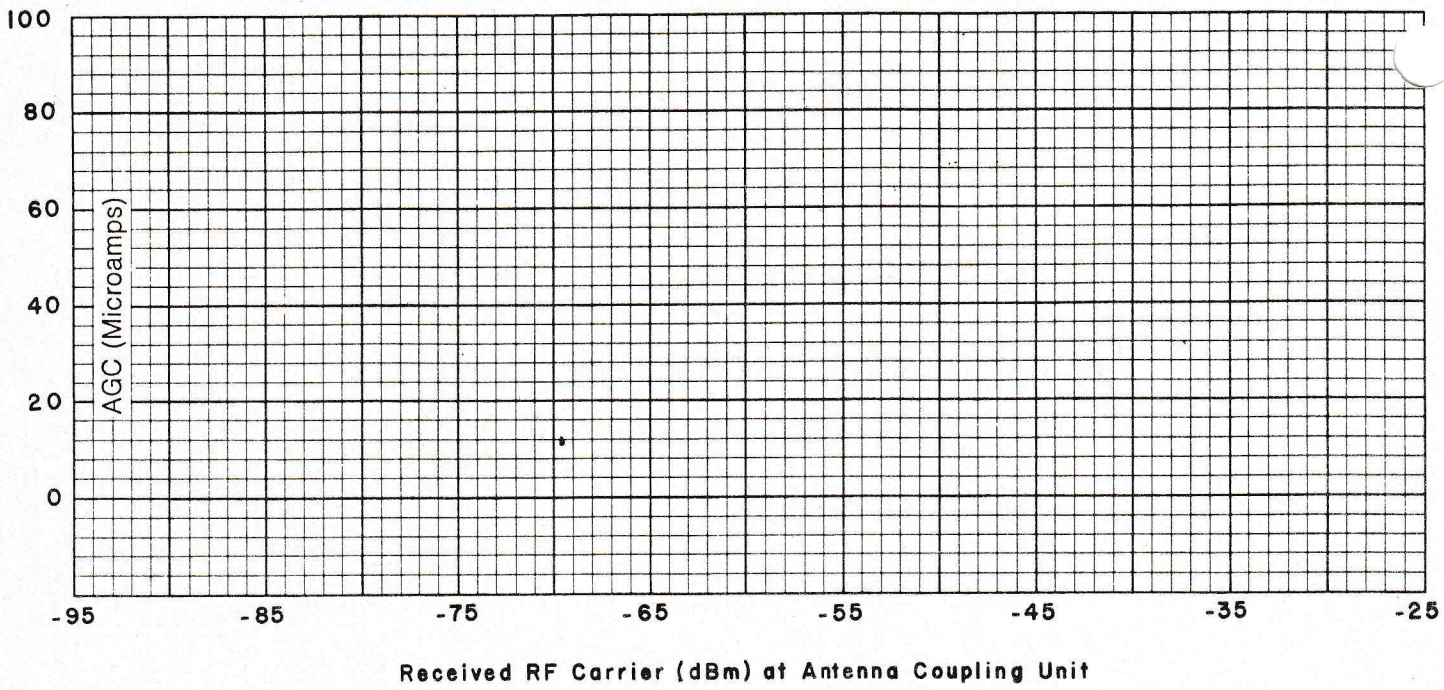


Fig. 1--Receiver AGC Curve

CHART 10

IF FILTER EQUALIZER

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Disconnect coaxial cables to IN and OUT jacks on IF FLT EQL unit.
2	Loosen two mounting screws on front of unit and remove unit.
	UNIT REPLACEMENT
3	Verify that option number of the new IF FLT EQL unit corresponds to the old IF FLT EQL unit.
4	Install new unit and tighten two mounting screws.
5	Reconnect coaxial cables to IN and OUT jacks on IF FLT EQL unit.
	ALIGNMENT
6	The IF FLT EQL unit is factory tuned and adjustment is not normally required.
7	Perform Baseband Frequency Response: Test Record and Subsequent Checks chart in AP.

CHART 11

LOCAL OSCILLATOR

APPARATUS:

(None)

STEP	PROCEDURE
	Note: This chart is written for transmitter LO replacement. Receiver LO replacement is identical. Substitute "receiver" for "transmitter" when replacing a receiver LO. Also delete Steps 10 and 15 when replacing the Receiver LO.

CHART 11 (Cont)

STEP	PROCEDURE
	UNIT REMOVAL
1	Switch the power off.
2	Slide the transmitter assembly forward in the frame.
3	Disconnect all external connections to the transmitter assembly.
4	Remove the transmitter.
5	Remove all connections to the LO unit.
6	Remove the three screws from the back plate that hold the LO.
	UNIT REPLACEMENT
7	Verify that the option number and frequency of the new LO corresponds to the old LO.
8	Install the new LO and tighten the mounting screws.
9	Replace all connections to the LO.
10	Replace the offset crystal in the AFC unit. Perform Chart 4.
11	Return the transmitter assembly to the radio frame.
12	Reconnect all external connections to the transmitter assembly.
13	Slide transmitter back into the frame.
14	Switch the power on.
15	Perform Transmitter Frequency Check and Adjustment chart in AP.

CHART 12

POWER SUPPLY ASSEMBLY

APPARATUS:

(None)

CHART 12 (Cont)

STEP	PROCEDURE
	Warning: This is an out of service procedure.
	UNIT REMOVAL
1	Turn off power to the radio rack.
2	Remove all cables from the power supply assembly.
3	Remove two screws located at both sides of the power supply assembly.
4	Remove power supply assembly.
	UNIT REPLACEMENT
5	Place new power supply assembly in position. Perform Steps 1 through 3 in reverse. (Change remove to replace, change turn off to turn on.)

CHART 13

RECEIVER CONTROL

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Loosen two mounting screws on front of unit and remove unit.
	UNIT REPLACEMENT
2	Verify that option number and strapping of new RCVR CONT unit are the same as the old RCVR CONT unit.
3	Install new unit and tighten mounting screws.
4	Verify RCVR CONT switch is set to AUTO.

CHART 14

MONITORED HOT STANDBY CONTROL

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Loosen two mounting screws on front of unit and remove unit.
	UNIT REPLACEMENT
2	Verify that strapping on new MHSB CONT unit is the same as the old MHSB CONT.
3	Install new unit and tighten mounting screws.
4	Verify MHSB CONT switch is set to AUTO.

CHART 15

POWER AMPLIFIER

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Switch the power off.
2	Slide the transmitter assembly forward.
3	Disconnect all connections to the Power Amplifier.
4	Remove the two screws on the back plate of the Power Amplifier.
	UNIT REPLACEMENT
5	Verify that the option number of the new Power Amplifier corresponds to the old Power Amplifier.

CHART 15 (Cont)

STEP	PROCEDURE
6	Install the new unit and tighten the mounting screws.
7	Replace all connections to the Power Amplifier.
8	Slide the transmitter assembly back into place.
9	Switch the power on.
	ALIGNMENT
10	Perform Transmitter Output Power Check chart in AP.

CHART 16

2-GHz AMPLIFIER

APPARATUS: (None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Switch the power off.
2	Slide the receiver assembly forward.
3	Disconnect all connections to the 2-GHz Amplifier.
4	Remove the two screws on the back plate that hold the 2-GHz Amplifier.
	UNIT REPLACEMENT
5	Verify that the option number of the new 2-GHz Amplifier corresponds to the old 2-GHz Amplifier.
6	Install the new unit and tighten the mounting screws.
7	Replace all connections to the 2-GHz Amplifier.
8	Slide the receiver assembly back into place.

CHART 16 (Cont)

STEP	PROCEDURE
9	Switch the power on.
	ALIGNMENT
10	Perform NODAN Alarm Threshold Check and Adjustment and Receiver Calibration/Transmitter Deviation Check and Adjustment (Receiver Calibration section) charts in AP.

CHART 17

2-GHz MIXER/PREAMPLIFIER

APPARATUS:

(None)

STEP	PROCEDURE
	UNIT REMOVAL
1	Switch the power off.
2	Slide the receiver assembly forward in the frame.
3	Disconnect all external connections to the receiver assembly.
4	Remove the receiver.
5	Remove all connections to the 2-GHz MIXER/PREAMPL.
6	Remove the mounting screws from the back plate that hold the unit.
	UNIT REPLACEMENT
7	Verify that the new unit is the same as the old unit.
8	Install the new unit and tighten the mounting screws.
9	Replace all connections to the 2-GHz MIXER/PREAMPL unit.
10	Return the receiver assembly to the radio frame.
11	Reconnect all external connections to the receiver assembly.

CHART 17 (Cont)

STEP	PROCEDURE
12	Slide the receive assembly back into the frame.
13	Switch the power on.
14	Perform NODAN Alarm Threshold Check and Adjustment and Receiver Calibration/Transmitter Deviation Check and Adjustment (Receiver Calibration section) charts in AP.

CHART 18

VOLTAGE REGULATOR

APPARATUS:

1--Digital Multimeter (DMM), Fluke 8000A

STEP	PROCEDURE
	UNIT REMOVAL
1	Switch the power to the regulator off.
2	Disconnect the regulator power cable from the power supply assembly.
3	Remove the four corner screws.
	UNIT REPLACEMENT
4	Verify that the replacement regulator is the same as the old unit.
5	Position the new unit on the back plate and replace the four corner screws.
6	Reconnect the regulator power cable to the power supply assembly.
	Warning: Depending upon which regulator is being replaced, one of the following power supply cables must be disconnected at the power supply assembly before proceeding with the next step. Failure to disconnect the cable may cause severe equipment damage.
	A Regulator: PWR SUPPLY A (J4).
	B Regulator: PWR SUPPLY B (J8).

CHART 18 (Cont)

STEP	PROCEDURE
7	Switch the power to the regulator on.
8	Connect a DMM to the test point next to the regulator power plug on the power supply assembly and adjust the regulator until the DMM indicates the voltage listed (-20V).
9	Compare assembly meter reading with DMM reading. **Requirement:** Voltage readings are the same. If requirement is not met, adjust CALIBRATE METER control on assembly meter to meet requirement.
10	Reconnect the power supply cable that was disconnected in Step 6.
11	Double check the voltage at the test point on the power supply assembly with the assembly meter. Readjust the regulator if necessary.

CHART 19

DIODE SWITCH

APPARATUS:

(None)

STEP	PROCEDURE
	Warning: The following sequence is critical. Failure to perform the steps in sequence may destroy the new switches. **Note:** Diode switches should be replaced in sets of three as the determination of which switch is defective is very difficult in the field. **UNIT REMOVAL**
1	Remove transmitter fuses F4 and F7 from power supply assembly.
2	Remove J2 PROTECTION ASSY cable from junction panel.
3	Remove all coaxial links to diode switch assemblies.
4	Remove assembly cover plates.

CHART 19 (Cont)

STEP	PROCEDURE
5	Remove the four large-headed screws on the switches.
6	Unsolder the orange, red, and brown wire leads.
	UNIT REPLACEMENT
7	Verify that the new switches are the same as the old switches, and tuned to the same frequency.
8	Solder the orange, red, and brown wire leads to the new switches.
	Note: Red/1; brown/G, orange/2.
9	Position the diode switches on the antenna coupling unit and replace the mounting screws.
10	Replace the cover plates.
11	Replace the coaxial links.
12	Replace J2 PROTECTION ASSY cable.
13	Replace fuses F4 and F7.

CHART 20

ASSEMBLY METER

APPARATUS:

1--Digital Multimeter (DMM), Fluke 8000A

STEP	PROCEDURE
	UNIT REMOVAL
1	Unplug the meter panel cable at the junction panel.
2	Remove the four mounting screws on the side wall of the radio frame.
3	Remove the meter assembly.

CHART 20 (Cont)

STEP	PROCEDURE
	UNIT REPLACEMENT
4	Verify that strapping options are the same on the new unit as on the old unit.
5	Repeat Steps 1 through 3 in reverse. (Change remove to replace. Change unplug to plug.)
	ALIGNMENT
6	Perform Transmitter Output Power Check in AP to calibrate the meter for transmitter power output.
7	Measure the voltage at the power supply assembly with DMM.
8	Measure the voltage at the power supply with assembly meter.
9	Compare assembly meter reading with DMM reading.
	Requirement: Voltage readings match.
	If requirement is not met, adjust CALIBRATE METER control on assembly meter to meet requirement.

Table A

Recommended Test Equipment List

APPARATUS:

1--RF Signal Generator (SIG GEN), Hewlett-Packard 8614A, or equivalent

1--Electronic Counter (COUNTER), Hewlett-Packard 5245L with Frequency Converter, Hewlett-Packard 5254C, or equivalent

1--Digital Multimeter (DMM), Fluke 8000A

1--Coaxial Dummy Load (COAX LOAD), 50 ohms, 25 watts, Engelmann Microwave Corp. T350N

1--Card Extender (EXTENDER), Farinon 83186

1--Patch Cord (N to N), N male to N male, Farinon 87-10147-06

1--Patch Cord (BNC to BNC), BNC male to BNC male, Farinon 87-10146-25

1--Adapter (N to SMA), N female to SMA female, Selectro SC50-622-6701-89

TECHNICAL INFORMATION

TYPE 16241-M2 AUTOMATIC FREQUENCY CONTROL

CONTENTS PAGE

1. FUNCTION

1.01 The Type 16241-M2 Automatic Frequency Control unit is used in a transmitter to control the frequency of the oscillator-modulator. The unit also provides outputs to power monitoring, pilot monitoring, and AFC alarm circuitry. When used in the B transmitter of an on-line protection system, the AFC circuit is switched to standby by an external control circuit. Table A provides a technical summary.

2. CIRCUIT DESCRIPTION

GENERAL

2.01 The Type 16241-M2 Automatic Frequency Control performs the following functions in a transmitter:

(a) Compares a down-converted 70 MHz sample of the transmitter RF output with a crystal-controlled reference, and generates an AFC output voltage proportional to the phase difference.

(b) Demodulates the continuity pilot, and forwards it to an external pilot detector.

(c) Forwards a dc signal, proportional to RF power, to external power monitoring circuitry.

(d) Generates an alarm in the event of AFC failure.

(e) In the B transmitter of an on-line protection terminal, responds to an input from an external control circuit.

2.02 Refer to Fig. 1 for a simplified block diagram of the 16241-M2 AFC unit.

AFC VOLTAGE

2.03 The 16241-M2 unit accepts input at J201 from an RF coupler in the transmitter output path, and at J202 from the transmitter local oscillator. The frequency of the crystal-controlled local oscillator (LO) differs by 70 MHz from the transmitter RF frequency; the LO crystal operates in a solid state oven for better frequency stability. The two signals are applied to a balanced ring-hybrid mixer.

2.04 The output of the mixer is amplified by an integrated circuit amplifier, Q203, and forwarded to a series of integrated digital dividers. Q204, Q206, Q208, and Q209 divide the frequency of the 70-MHz IF signal down to approximately 35 kHz. Q207, in the midst of the divider chain, coordinates levels between the ECL and TTL logic. Depending on whether the local oscillator signal is above or below the RF frequency, the output of the divider chain goes to either the inverting or non-inverting input of phase detector Q210 (see Table A on SD-16241-M2).

2.05 The other input to the phase detector is obtained from the output of a crystal-controlled reference oscillator, Q212 and associated components. The 8.75-MHz oscillator signal is amplified by Q213 and then divided down by Q214 and Q215 to approximately 35 kHz.

2.06 The output of the phase detector contains a dc component proportional to the phase difference between the input signals, and thus can be used as a control

voltage. This component passes via filter R234-C224-C225 to an integrated circuit amplifier, Q211 and associated components. Finally, the amplified signal is forwarded through AFC OUT jack J204 to the transmitter oscillator-modulator.

2.07 This AFC voltage controls the frequency of the oscillator-modulator so as to hold the two 35-kHz signals in a fixed phase relationship. As a result, their frequencies must be identical, which in effect forces the IF input signal to be 70 MHz, within the tolerance of the reference oscillator.

PILOT RECEIVER

2.08 The AFC unit provides a baseband output to an external pilot detector. A sample of the 35-MHz signal present at the output of frequency-divider Q204 is applied to IF amplifier Q201. A discriminator, CR204-CR205 and associated components, then recovers the baseband signal containing the continuity pilot. This signal is forwarded through emitter-follower Q202 to PLT OUT jack J203.

POWER MONITOR

2.09 Current in the ring-hybrid mixer of the AFC unit is proportional to the transmitter RF output level. A sample of the mixer current is connected via feedthrough capacitor FL2 to an external power monitor. If the RF level drops by a preset amount, typically 6 dB, the monitor circuit indicates an alarm.

AFC ALARM

2.10 If the transmitter frequency is beyond the locking range of the phase detector, a condition that occurs when the transmitter is first turned on, the phase detector functions as a wide-band frequency discriminator. Then, the AFC voltage is at its most negative value if the RF frequency is too low, or at its most positive value if the RF frequency is too high. Thus, the transmitter frequency is pulled rapidly toward reference. When it reaches locking range, the phase detector locks and holds.

2.11 The AFC alarm circuit, consisting of Q216-Q220, Q222 and associated components, serves two purposes: it helps set the transmitter on frequency quickly when power is first turned on, and performs alarm and control functions in the event of an AFC failure.

2.12 In normal operation, the voltage from pin 2 of Q210, the phase detector, is near zero. Q216 is off, Q217 and Q219 are on, Q220 is off, C236 is discharged, and C237 is charged. Emitter-follower Q218 forwards -19 volts through FL7, indicating a normal, no-alarm condition. If phase-lock is lost, these conditions are reversed. Pin 2 of Q210 becomes negative, turning Q216 on. After a delay caused by time constants R252-R253-C236 and R259-C237, switch Q220 is closed. C236 charges through R253-R252, because Q217 is turned off by Q216. When C236 is charged, Q219 turns off and C237 discharges through R259, turning on Q220. This applies the voltage at the middle of divider R263-R262 to pin 3 of Q211, overriding the phase detector output and fixing the AFC voltage at -5.1 volts, which is the normal on-frequency voltage. Q216 on causes Q218 to turn off and Q222 to turn on. The junction of the emitters of Q218 and Q222 are drawn toward zero volts, signaling an alarm condition at pin B of P1 (AFC ALM).

2.13 A similar condition is forced manually when the AFC/MFC switch is set to MFC position: Q216 is forced on when the collector of Q217 is grounded through CR208, thus causing an alarm indication from Q218, and Q220 is turned on by ground through CR210 to provide the fixed AFC voltage as described above for loss of AFC. Grounding the collector of Q217 also discharges C236, which allows the loop to relock when the switch is returned to AFC position.

2.14 When the transmitter is first turned on, C237 is discharged. It holds Q220 on long enough to charge C224, and then opens Q220 to allow the loop to lock. In this manner, the lock-in time is reduced to about one second. If, for any reason, phase lock is not established, the alarm condition is

reimposed as C236 becomes charged, the fixed voltage is applied again, and an alarm is signaled. This takes about five seconds.

PROTECTED TRANSMITTERS

2.15 The frequency of the oscillator-modulator in an unprotected transmitter is determined by the AFC voltage generated in its own AFC unit. This is also true of the A transmitter in an on-line, phase-locked protection system. However, to ensure that the A and B transmitter frequencies are identical, the B AFC output is disabled and the B transmitter frequency is controlled by an external phase lock loop that compares the two transmitter outputs. The B AFC is normally disabled by a ground applied to pin A of P1 via the APC/AFC CONTROL lead. This ground passes through CR211 to turn on Q220 and provide a fixed -5.1 volt AFC output, as previously explained, and also passes through CR209 to the base of Q216 to provide a "normal" input to the AFC alarm circuit.

3. REFERENCE

SD-16241-M2 - Schematic Diagram

Table A

Technical Summary

RF Input Level	+10 dBm ± 5 dB	
LO Input Level	0 dBm ± 2 dB	
RF and LO Input Impedances	50 ohms, nominal	
AFC Output Voltage	-5.1 Vdc, nominal (-3.2 to -7.3 Vdc)	
Frequency Stability	± 0.002% of IF	
Pull-in Range	± 10 MHz at RF	
AFC Time Constant	2.5 seconds	
Test Points (approx. readings in divisions, using 100 µA input to assembly meter)	Normal	Alarm
IF LEV, TP1 (red)	15, minimum	
DISC, TP2 (blue)	14 to 16	
PD, TP3 (green)	0 to 5	10 to 30
VOLT, TP4 (yellow)	14 to 16	14 to 16
Power Requirements	250 mA at -21 Vdc	
Operating Ambient Temperature Range	-30° to +55°C (-22° to +131°F)	
Mounting	Attaches to rear wall inside transmitter frame.	

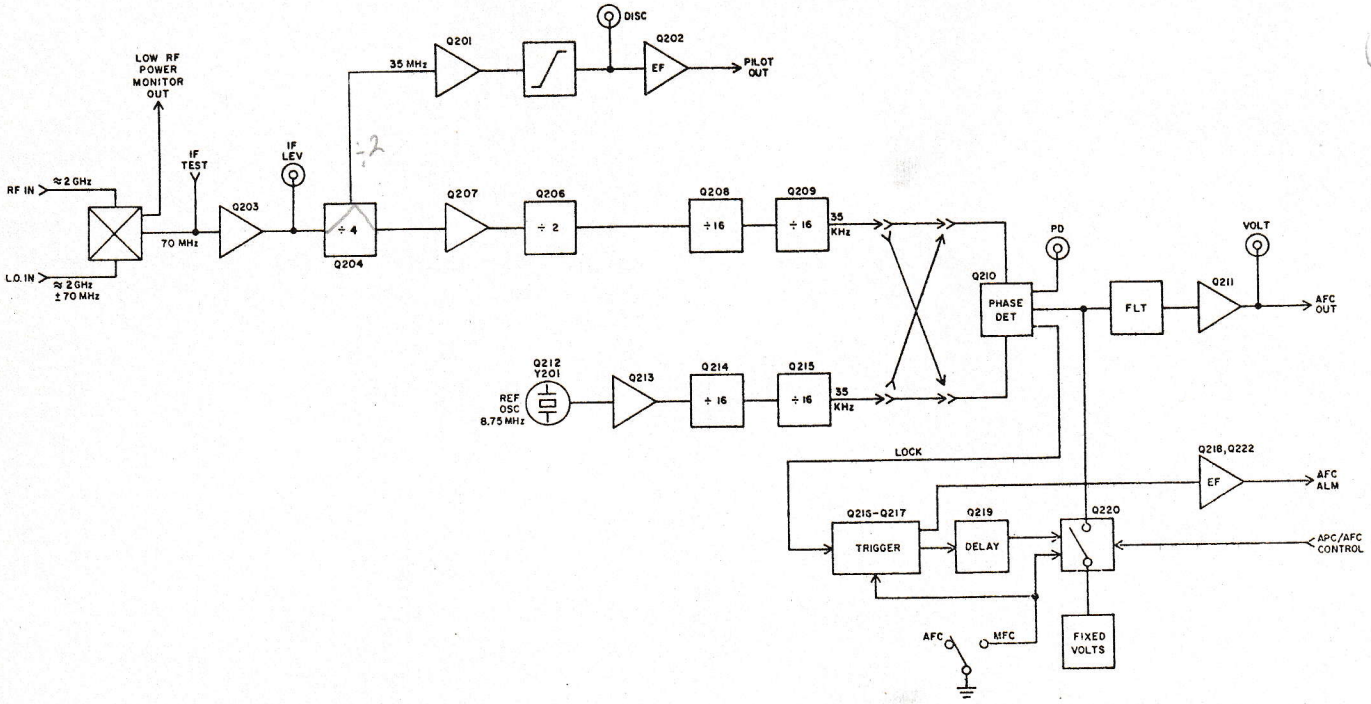


Fig. 1--Block Diagram of 16241-M2 AFC

TECHNICAL INFORMATION

TYPE 16243 OSCILLATOR-MODULATOR (1850-2000 MHz)

CONTENTS PAGE

1. FUNCTION

1.01 The Type 16243 Oscillator-Modulator is a frequency-modulated RF oscillator for use in a 2 GHz radio transmitter. The free-running oscillator is stabilized to operating frequency by control voltage from an external AFC or phase lock circuit. Refer to Table A for the technical summary.

2. CIRCUIT DESCRIPTION

2.01 The 16243 Oscillator-Modulator unit consists of a free-running oscillator stabilized to the operating frequency by an external AFC circuit, or by a phase-lock circuit in the case of a slave transmitter in a protected system. Refer to Fig. 1 for a simplified block diagram of the unit.

2.02 Baseband signals enter the unit at coaxial jack J1 and pass through a pad to an RF low-pass filter consisting of L301, C301, and C302. The low-pass filter prevents any RF from an adjacent transmitter from interfering with the baseband. A temperature compensating network consisting of RT301 and R308 improves deviation stability. The transmitter deviation level is set by BB LEV potentiometer R2. The baseband signals are coupled through C303, R1, and R201 to varactor modulator CR201.

2.03 The oscillator, Q201, and associated components, uses a grounded collector configuration with modulating high Q varactor diodes (CR201) placed in the emitter circuit. The varactor diodes are connected back-to-back, and function as voltage-variable capacitors. As long as no modulation is present, both diodes maintain a constant capacity due to a dc bias, which originates from an external AFC or phase-lock circuit, and enters the unit through jack J2 or J4 respectively. However, when modulation is applied, the capacitance of each diode varies from the constant value set by the fixed bias, and thus varies the impedance of the oscillator circuit. This causes the oscillator output frequency to shift at a rate that corresponds to the modulating frequency. The output signal, from the base of Q201, passes through C205 and an isolator to the RF output coaxial connection. The isolator reduces interface interaction between the oscillator-modulator and the driver amplifier.

2.04 A low-pass filter consisting of R202, C206, and C208 removes low frequency noise components from the power supply input to the oscillator circuit. Capacitor C204 (FREQ ADJ) is used for tuning the frequency in the 1850-2000 MHz band. C205 (OUTPUT ADJ) is a loading control, which is normally tuned for maximum output. C1 is a balancing (phasing) control for CR201 which is only tuned when noise loaded measurements are being made and should not be used for any other purpose. TEST jack J3 is used during factory alignment, before the unit is placed in the transmitter.

3. REFERENCE

SD-16243 - Schematic Diagram

Table A

Technical Summary

Output Frequency Range	1850 to 2000 MHz
Output Level	+17 ±1 dBm
Output Impedance	50 ohms
AFC Voltage	-5.1 Vdc, nominal
Baseband Input Impedance	75 ohms, unbalanced
Baseband Input Level	Depends on channel capacity of radio
Option -001	-15 dBm provides 200-kHz rms deviation
Option -002	-12 dBm provides 200-kHz rms deviation
Option -003	-12 dBm provides 200-kHz rms deviation
Deviation Characteristics	
Frequency Response	±0.2 dB, 0.3 to 6000 kHz
Stability	±0.25 dB
Oscillator Deviation	±10 MHz per volt minimum
Power Requirements	
Options -001 and -002	50 mA at -21 Vdc
Option -003	50 mA at -20 Vdc
Mounting	Attaches to wall of transmitter.

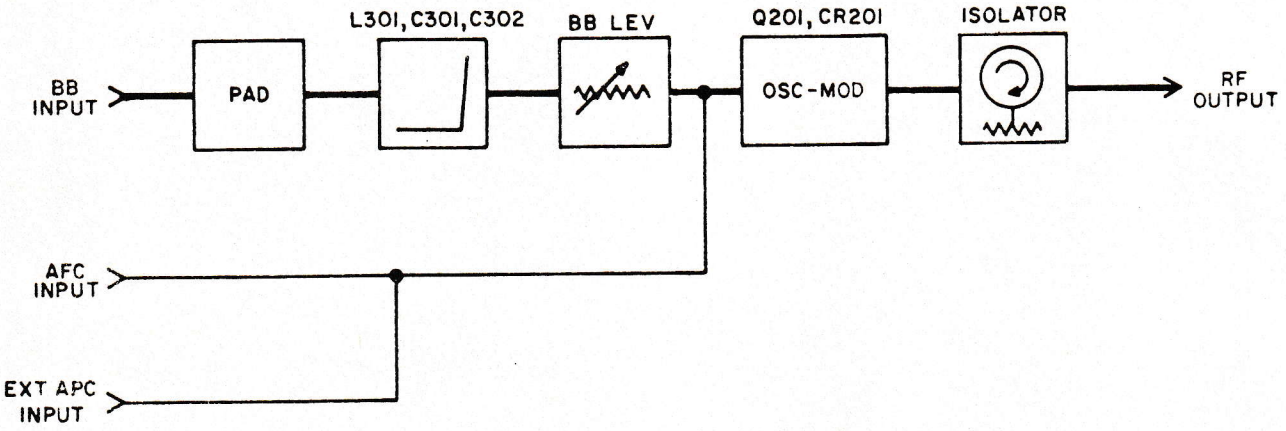


Fig. 1—Block Diagram of 16243 Unit

TECHNICAL INFORMATION

TYPE 16251 LOCAL OSCILLATOR

CONTENTS PAGE

1. FUNCTION

1.01 The Type 16251 Local Oscillator is used in a 2 GHz transmitter or receiver to generate an RF signal in the 1630 to 2070 MHz range. Refer to Table A for the technical summary.

2. CIRCUIT DESCRIPTION

2.01 The Type 16251 Local Oscillator consists of a crystal-controlled oscillator, a doubler, an amplifier, a diode harmonic generator, and an output filter, as shown in Fig. 1.

2.02 Frequency control is obtained by means of crystal Y201 in the base-emitter circuit of oscillator transistor Q201. As shown in Table A of SD-16251, the crystal frequency is selected in the range from 90 to 100 MHz. The oscillator output is tuned by L202-C206 to the crystal frequency range, and is applied to doubler transistor Q202. By adjusting C207, the network at the output of Q202 is tuned to twice the crystal frequency. The signal is then amplified by Q203 and forwarded through another tuned network. This network, adjusted by C204, tunes the amplifier output to 2 times the crystal frequency and matches its impedance to the input impedance of CR201. CR201, a step-recovery diode, generates harmonics of the doubler frequency. The desired harmonic frequency is selected by two-cavity bandpass filter FL201 and forwarded to output cable W1.

2.03 TP1 monitors the bias current through CR201 and is used at the factory for frequency tuning. Field adjustment of 16251 units is not normally required.

2.04 When the Type 16251 Local Oscillator is used in a transmitter, crystal Y201 is equipped with an oven to ensure frequency stability within ±0.0001%.

3. REFERENCE

SD-16251 - Schematic Diagram

Table A

Technical Summary

Output Frequency Range	1630 to 2070 MHz
Output Level	
Transmitter	0 dBm ±1 dB
Receiver	+3 dBm, minimum
Output Impedance	50 ohms

Table A (Cont)

Frequency Stability	
W/O Oven	±0.001%
With Oven	±0.0001%
Power Requirements	
W/O Oven	30 mA at -21 Vdc
With Oven	100 mA at -21 Vdc
Mounting	Fastens to wall of transmitter or receiver.

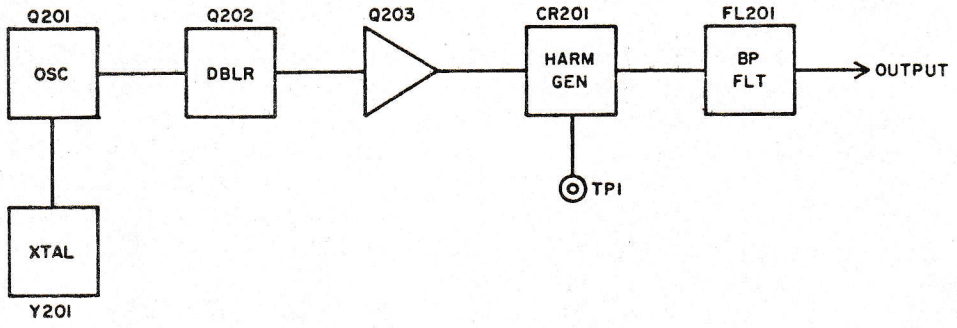


Fig. 1—Block Diagram of 16251 Unit

TECHNICAL INFORMATION

TYPE 83144 TRANSMITTER BASEBAND AMPLIFIER

CONTENTS PAGE

1. FUNCTION

1.01 The Type 83144 Transmitter Baseband Amplifier is used in FL and FM series transmitters to provide amplification and pre-emphasis for baseband signals for a protected or non-protected Microwave Radio System. The amplifier is also available without de-emphasis. Refer to Table A for the technical summary.

2. CIRCUIT DESCRIPTION

2.01 The Type 83144 unit consists of an input amplifier, an optional pre-emphasis network, a level adjust control and an output amplifier. Fig. 1, at the end of this publication, is a simplified block diagram of the 83144 unit.

2.02 Baseband signals from the interface unit enter the 83144 unit through the J1 HIGH IMP jack and are coupled through C5 to an input amplifier consisting of Q3, Q4, Q7, Q8, and Q10 with Q9 acting as a constant-current source. Amplifier feedback stabilization is provided by a path through R23 to the emitter of Q7. The amplifier output from Q10 is coupled through C16 to the pre-emphasis network (R37, R38, L3, and C18). (R37 and R38 are removed when de-emphasis is not used.) The values of L3 and C18 are equipped per Table A on SD-83144 for the various channel capacity options. Fig. 2 shows the typical pre-emphasis characteristics for each channel capacity option. The amplified output of Q10 is also forwarded to the MON -30 dBm jack. This monitors the signal prior to pre-emphasis.

2.03 The signal passes through a LEVEL ADJ control, R33, and is then coupled through C17 to the output amplifier consisting of Q12, Q5, Q2, and Q1 with Q11 supplying temperature compensation for Q12. The output of Q12 is applied to Q5 whose output drives the bases of Q1 and Q2 through R11 and diodes CR1 and CR2 with Q6 acting as a constant-current source. The output stage is a complementary amplifier, Q1 and Q2, with a low output impedance. This is built-out by R1 to a nominal 75-ohm impedance required at the OUT jack. Amplifier feedback stabilization is provided by a path through R18 to the emitter of Q12.

2.04 Impedance matching network C20, R40-R41 provides a LOW FREQ PILOT OUTPUT for use with FM series transmitters with on-line protection equipment.

3. REFERENCE

SD-83144 - Schematic Diagram

Table A

Technical Summary

Baseband Input Level (with Interface Unit)	-25 dBm/-25 dBm/-35 dBm
MON Level	-30 dBm
Pre-Emphasis (CCIR)	See table on SD-83144
Baseband Output Impedance	75 ohms, unbalanced
Baseband Output Level	See table on SD-83144
LOW FREQ PILOT Output	
Level	-47 dBm
Impedance	50 ohms, unbalanced
Power Requirements	160 mA at -20 Vdc
Operating Ambient Temperature Range	-30° to +55°C (-22° to +130°F)

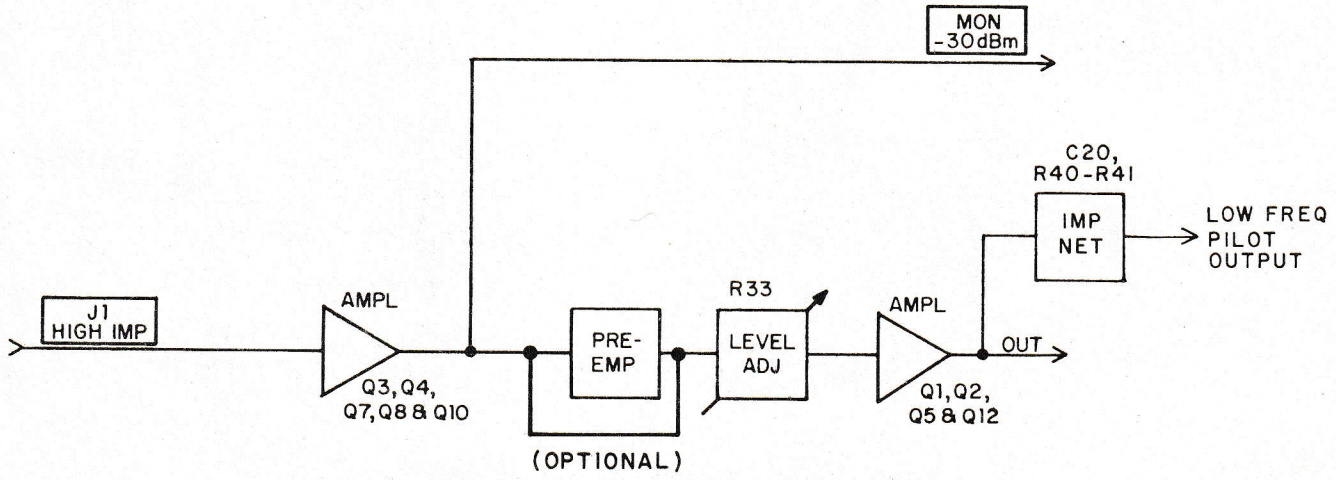


Fig. 1—Type 83144 Transmitter Baseband Amplifier

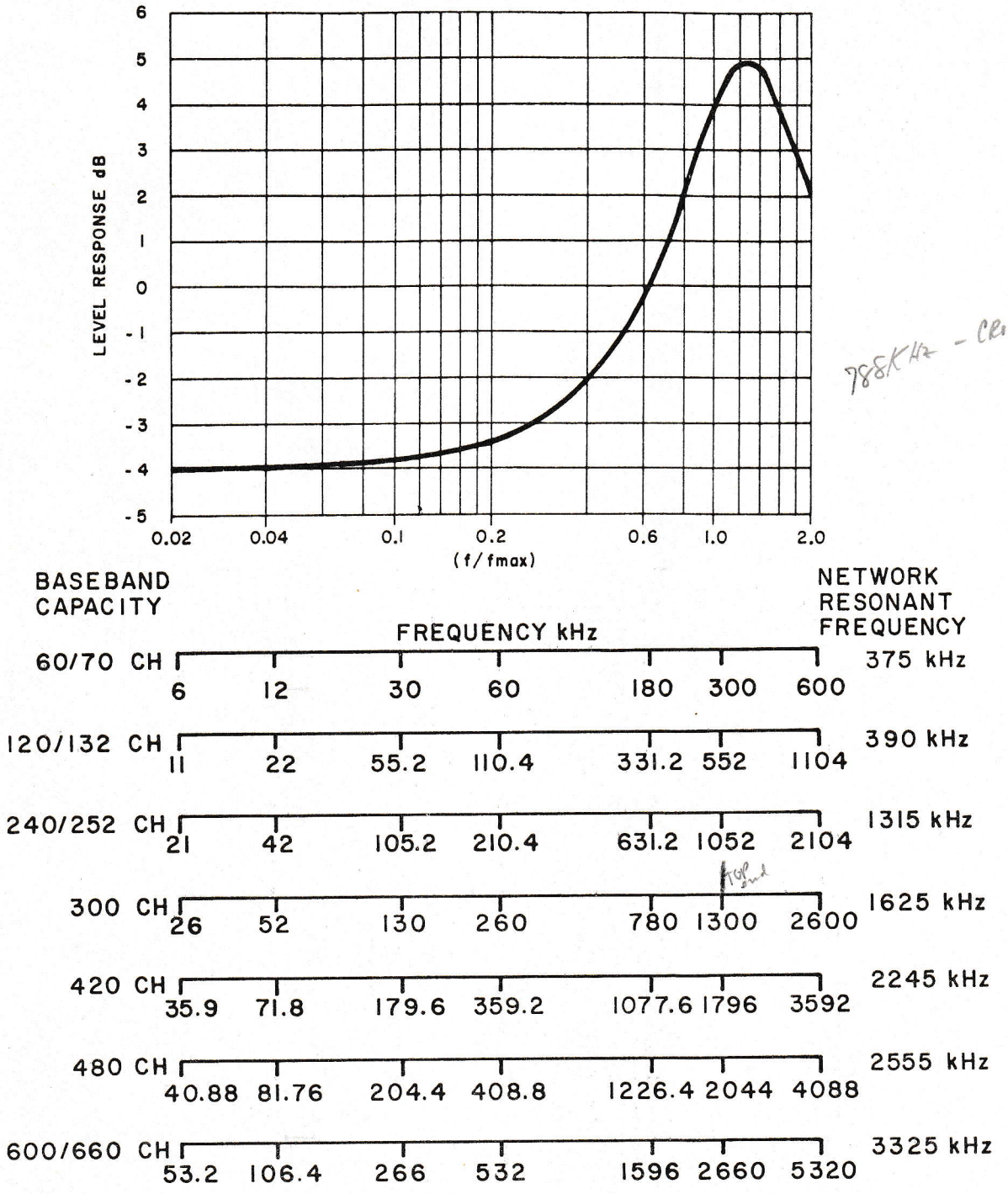


Fig. 2—Baseband Amplifier (~~De~~ Pre-Emphasis) Response for 60, 120, 240, 300, 420, 480, and 600 Channel Loading

TECHNICAL INFORMATION

TYPE 83147 RECEIVER BASEBAND AMPLIFIER

CONTENTS PAGE

1. FUNCTION

1.01 The Type 83147 Receiver Baseband Amplifier is used in FL and FM series receivers to provide amplification and de-emphasis for baseband signals for a protected or non-protected Microwave Radio System. The amplifier is also available without de-emphasis. Refer to Table A for the technical summary.

2. CIRCUIT DESCRIPTION

2.01 The Type 83147 unit consists of a baseband level adjust control, an input amplifier, (a de-emphasis circuit, if equipped) an output amplifier, a relay circuit, and a dc alarm circuit. Fig. 1, at the end of this publication, is a simplified block diagram of the 83147 unit.

2.02 Baseband signals from the limiter-demodulator unit enter the unit through the IN jack and pass through the LEV ADJ control, R1, to amplifier Q1. The output of Q1 is amplified by Q2 and Q4 with Q3 acting as a constant-current source. Amplifier feedback stabilization is provided by the path through R10 to the emitter of Q1. The amplified output of Q4 is coupled through C10 into the de-emphasis network (R32, R31, C11, and L3). (R32 and R34 are removed when de-emphasis is not used.) The values of L3 and C11 are equipped per Table A on SD-83147 for the various channel capacity options. Fig. 2 shows the typical de-emphasis characteristics for each channel capacity option.

2.03 The signal is coupled through C17 to amplifier Q10 with Q8 supplying temperature compensation for Q10. The output of Q10 is applied to amplifier Q7 whose output drives the bases of Q5 and Q6 through R25 and diodes CR2 and CR3. Q9 is also a constant-current source with CR5 and CR6 providing temperature compensation. The output stage is a complementary amplifier, Q5 and Q6, with a low output impedance. Amplifier feedback stabilization is provided by a path through R27 to the emitter of Q10. The output of the complementary amplifier is coupled through C3 and C21 to two output jacks: TEST OUT -30 dBm and J3 LOW IMP.

2.04 The signal at J3 LOW IMP jack is determined by the status of relay K1. In the normal condition, Q11 is biased on energizing the relay. During an alarm or maintenance condition, -20 volts is applied on pin E which biases Q11 off, de-energizing relay K1. In a protected system, no strap X in-place, the signal is applied to the TEST OUT -30 dBm jack when relay K1 is de-energized. In a non-protected system, strap X in-place, a signal is always present at the TEST OUT -30 dBm jack regardless of the relay status. TP1, MUTED 0 μA, is provided for measuring relay status with the assembly meter.

2.05 A dc alarm circuit, consisting of Q12 and its associated components, monitors the final amplifier output by sampling the dc voltage at the emitter of Q7 and the amplifier output which is rectified by CR7. CR7 maintains the correct voltage at the input to Q12. When the output dc voltage falls below this level, CR7 conducts and changes the input level to Q12. If either of these dc levels changes significantly, an alarm is generated by Q12 and leaves the 83147 unit on pin C. The alarm point is adjusted by R49, ALARM ADJ.

3. REFERENCE

SD-83147 - Schematic Diagram

Table A

Technical Summary

Power Requirements	160 mA at -20 Vdc
De-Emphasis (CCIR)	See Table A on SD-83147
Baseband Input Impedance	75 ohms, unbalanced
Baseband Input Level	See Table B on SD-83147
Baseband Output Level (with Interface Unit)	-15 dBm/-25 dBm/-25 dBm
TEST OUT Level	-30 dBm
Test Point (TP1)	MUTED 0 μA
Operating Ambient Temperature Range	-30° to +55°C (-22° to +131°F)

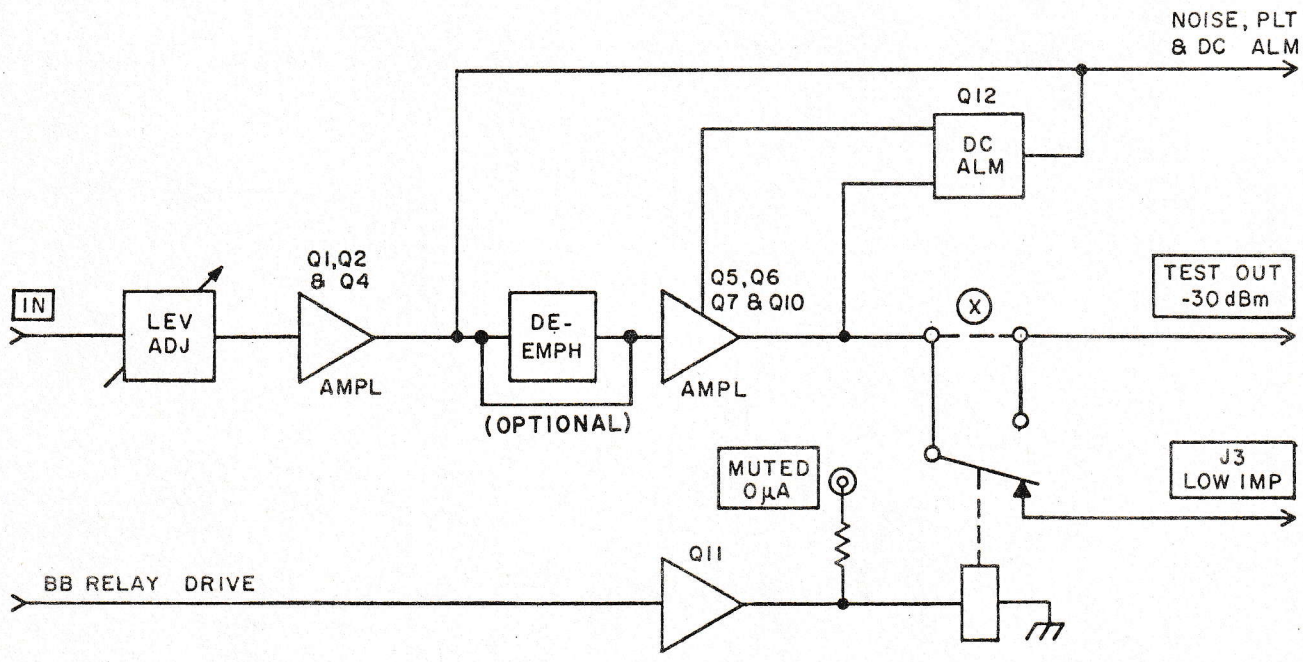


Fig. 1—Type 83147 Receiver Baseband Amplifier

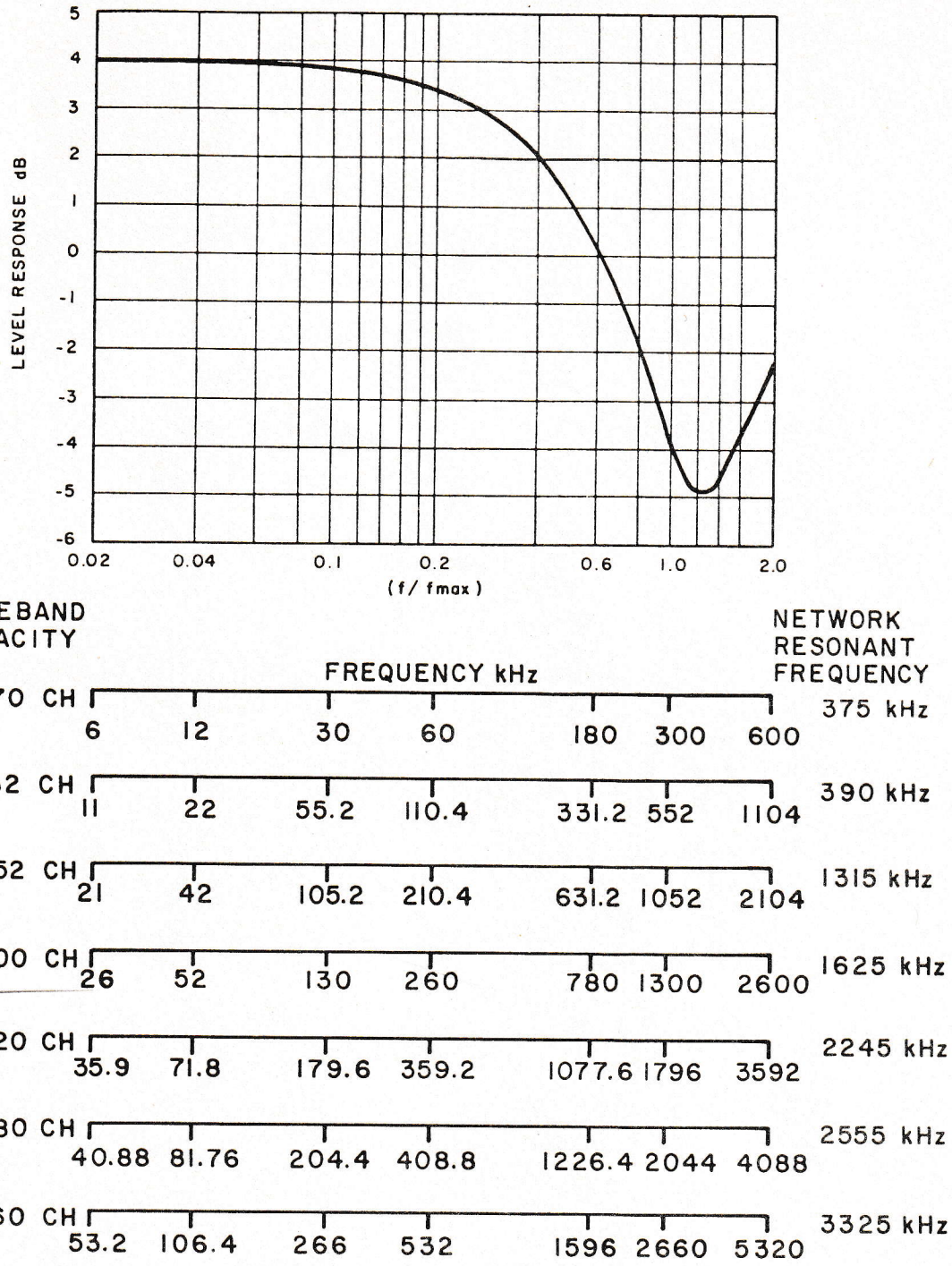


Fig. 2—Baseband Amplifier (De-Emphasis) Response for 60, 120, 240, 300, 420, 480, and 600 Channel Loading

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TECHNICAL INFORMATION
TYPE 83149-M2 LIMITER DEMODULATOR

REFERENCE

SD-83149-M2 - Schematic Diagram

FUNCTION

The Type 83149-M2 Limiter Demodulator unit is used in an FL series receiver. The Limiter section minimizes amplitude variation of the 70-MHz IF signal before demodulation and suppresses unwanted product frequencies generated by the limiting process. In addition, the demodulator section extracts and amplifies the baseband signal from the 70-MHz IF signal.

TECHNICAL SUMMARY

Input	
Frequency	70 MHz
Level	-4 dBm, nominal
Impedance	75 ohms, unbalanced
Return Loss	>30 dB, ±6 MHz
Delay Distortion	5 ns, ±6 MHz
Linearity	2% peak-to-peak, ±6 MHz
Output	
Level (200-kHz Deviation	-28.5 dBm ±1 dB
Impedance	75 ohms, unbalanced
Discriminator Zero (at 70 MHz)	0 µA
Sensitivity	1 µA/MHz, approximately
Power Requirements	140 mA at -20 Vdc
Mounting	Occupies one shielded plug-in position in an FL series receiver assembly.

CIRCUIT DESCRIPTION

A. General

The 83149-M2 unit consists of a input buffer amplifier, a limiter, a 70-MHz lowpass filter, an IF amplifier, a discriminator, and a baseband amplifier. Refer to Figure 1, at the end of this publication, for a simplified block diagram of the 83149-M2 unit.

B. Limiter Section

IF signals enter the unit through coaxial jack, IN, and pass through an input network consisting of R49, R50, R54 and L10. R54 and L10 are adjusted to improve the return loss. The IF signal is coupled through C41 to the buffer amplifier, Q8, which drives the limiter.

The limiter consists of differential-amplifier Q6 and Q7. CR4, CR5, R37 and R39 provide a constant-current source with R37 adjusting the limiter output for the desired IF output. The limiter output is coupled through C34 to the 70-MHz filter which contains three factory-adjusted tuned circuits isolated from the input and output by resistive pads. The output from the filter is then coupled through C3 to a two-stage IF amplifier consisting of Q1 and Q2. Voltage and current feedback is provided to stabilize gain and provide approximately 75 ohm input and output impedance. The amplified signal, at +10 dBm, is then coupled through C4 to the demodulator section.

C. Demodulator Section

The amplified IF signal is applied to a linearity correcting network, LIN ADJ, consisting of C5, C8, L2 and R13 and then to the high tank circuit, L4 and C10, and the low tank circuit, L3 and C9. The signals are applied to the slope detector diodes, CR2 and CR1, which recover the baseband signals from the IF signal. Summing resistors R17 and R18 combine the baseband signals which are coupled through C13 to the lowpass filter, C14-C16 and L11. This filter removes any 70-MHz signals. The output of the filter is then applied to a three-stage, high-input, low-output impedance baseband amplifier consisting of Q3-Q5. This amplifier provides the flat gain necessary for the required output level. R34 provides the necessary 75-ohm output impedance at the OUT jack.

The test point, DISC ZERO, is used with the assembly meter to provide an indication when an "on-frequency" signal is being received. An "on-frequency" indication is 0 µA on the assembly meter.

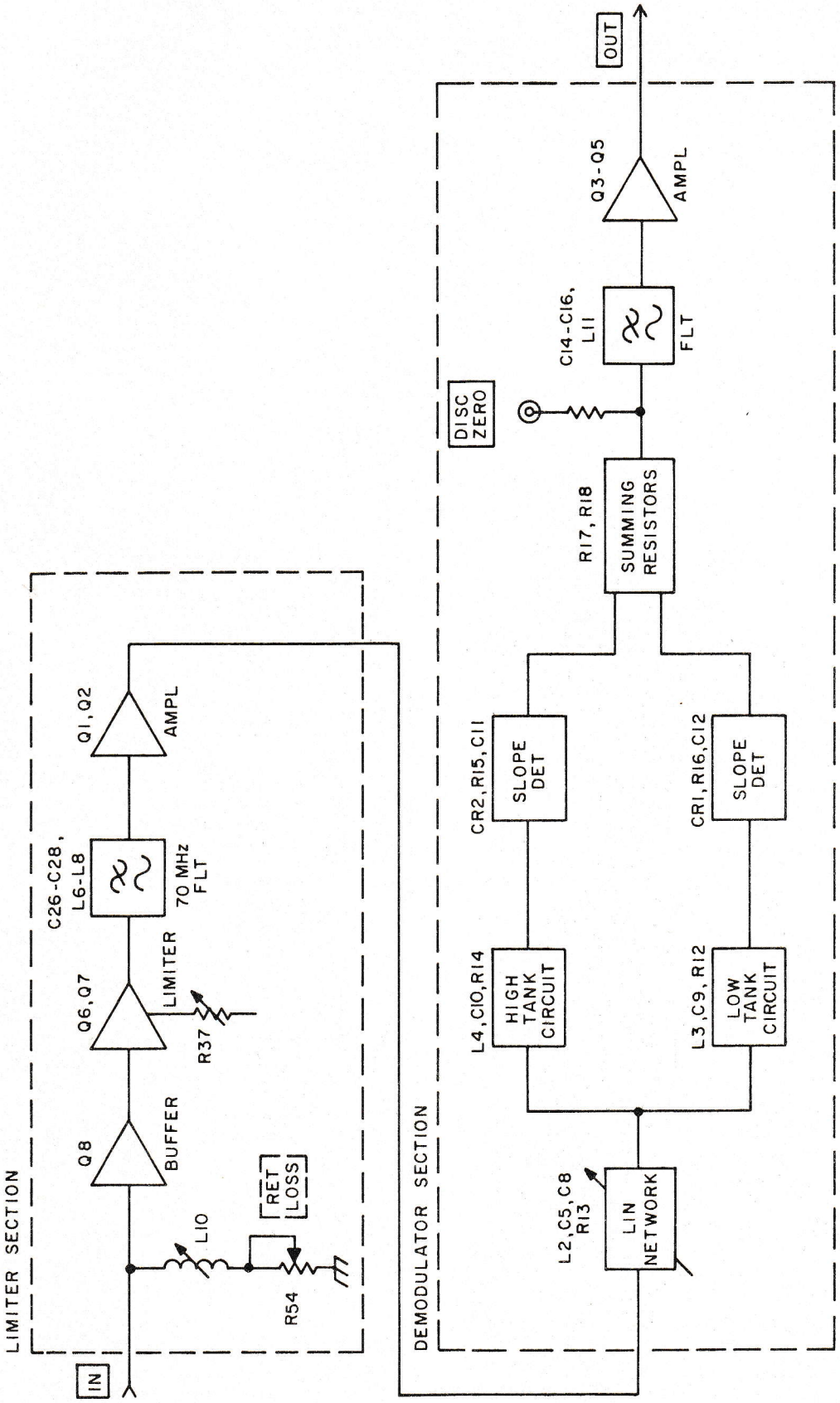

FIGURE 1. TYPE 83149-M2 LIMITER DEMODULATOR

TECHNICAL INFORMATION

TYPE 83150 RECEIVER ALARM

CONTENTS PAGE

1. FUNCTION

1.01 The Type 83150 Receiver Alarm unit is equipped in each protected receiver to monitor pilot and noise in each receiver and to generate alarms. A summed alarm signal is forwarded to the assembly meter. Individual alarm outputs (NODAN, PILOT, and NOISE LEVEL) are forwarded to the receiver control unit to control baseband receiver muting. External relay connections are provided for customer alarm equipment.

2. CIRCUIT DESCRIPTION

GENERAL

2.01 Fig. 1, at the end of this publication, is a simplified block diagram of the 83150 unit. The unit includes the following circuits: (1) pilot receiver, (2) pilot alarm, (3) NODAN alarm, (4) log amplifier, (5) noise amplifier alarm, (6) dc alarm, and (7) alarm relay. Table A contains a technical summary.

2.02 Input signals from the receiver baseband amplifier enter the 83150 unit on pin 21. These signals then pass to amplifier Q17. Q17 has two outputs: one to the pilot receiver and one to the noise circuits. The dc alarm on the input to the 83150 unit is also applied to the pilot alarm circuit.

PILOT RECEIVER AND PILOT ALARM

2.03 The signal applied to the pilot receiver passes to phase splitter stage Q6. A PLT TEST pushbutton is also provided for in-service testing and adjustment (PLT control) of the pilot alarm point. Q6 has equal value emitter and collector load resistors (R16 and R17), which are connected through crystal Y1 and variable capacitor C17, respectively, to a common output point. With capacitor C17 adjusted to equal the crystal capacitance, noise cancellation and interstage isolation will be maximum. However, when a pilot is present, it will pass through the crystal at a much higher level than through C17 with cancellation being negligible to the pilot signal. The pilot signal is applied to Q4 in the pilot alarm circuit. Pilot output from Q4 is detected and passed to comparator Q10A. In the absence of the pilot signal or a drop in pilot signal level, Q10A provides a PILOT ALM OUTPUT to the receiver control unit on pin 14, applies the alarm signal to Q1 which lights the PLT indicator, and provides an alarm signal to the DIODE OR GATE. Refer to the description below for the alarm relay circuit.

NODAN ALARM

2.04 The input signal to the NODAN alarm circuit is derived from the output of Q17 through the NOISE FLT and amplifier Q7 and Q8. The signal is coupled through C8 to detector CR3 in the NODAN alarm circuit. The detected signal is applied to comparator Q10B. If the noise signal exceeds a preset level, determined by the NODAN control, Q10B provides a NODAN ALARM OUTPUT signal to the receiver control unit on pin 15, applies the alarm signal to Q2 which lights the NODAN indicator, and provides an alarm signal to the DIODE OR GATE. Refer to the description below for the alarm relay circuit.

LOG AMPLIFIER AND NOISE AMPLIFIER ALARMS

2.05 The input signal to the log amplifier circuit is derived from the output of

Q17 through the NOISE FLT and amplifier Q7 and Q8. The signal is coupled through C8 to the two inputs of the log amplifier circuit. One input is applied directly to logarithmic amplifier Q5 and the other is applied to amplifier Q9, which provides approximately 30 dB of gain, and then to the other input to Q5. Q5 performs the summation of the two logarithmic response curves and provides a linear output over a 50-dB range. The output of Q5 is rectified by CR1 and CR2 to become the logarithm of input power. The rectified signal is applied to dc amplifier Q10C and then to comparator Q10D in the NOISE AMPL ALM circuit and supplies a NOISE LEV signal to the receiver control unit on pin 12.

2.06 In the event of a noise alarm or a failure of the logarithmic amplifier, determined by the NOISE AMPL control, comparator Q10D provides a NOISE AMPL ALM signal to the receiver control unit through CR10 on pin 12, applies the alarm signal to Q3 which lights the NOISE AMPL indicator, and provides an alarm signal to the DIODE OR GATE. Refer to the description below for the alarm relay circuit.

2.07 Controls NOISE LEV, LOG SLOPE, and NOISE AMPL are factory set and do not require field adjustment. LOG AMPL test point is used to measure the output dc level of the logarithmic amplifier with the assembly meter.

DC ALARM

2.08 If the final output stage of a receiver baseband amplifier unit fails, a dc alarm signal is applied to the 83150 unit on pin 21. This signal is applied to comparator Q10A. The comparator will then generate a pilot alarm as previously described.

ALARM RELAY

2.09 In the event of any alarm condition (PLT, NOISE AMPL or NODAN) being applied to the DIODE OR GATE, the output of the gate will change logic states and be applied to Q15 and Q12. Q15 will be biased on, forwarding a ground to the assembly meter to light the assembly meter indicator.

2.10 The alarm signal is also applied to the alarm relay circuit. In a normal ("no alarm") condition, Q12, Q13, and Q16 will be biased off, energizing relay K1. If strap option Z is in-place, C32 will be discharged. In an alarm condition from the DIODE OR GATE, Q12, Q13, and Q16 will be biased on causing relay K1 to de-energize. If strap option Z is in-place, relay K1 will de-energize after C32 charges (approximately 15-25 seconds). Normally open or normally closed relay contacts, determined by strap option X or Y, are provided for customer alarm equipment.

3. REFERENCE

SD-83150 - Schematic Diagram

Table A

Technical Summary

Input Impedance	75 ohms at TEST IN jack
Visual Indications (Alarms)	PLT, NODAN, and NOISE AMPL
Test Point	LOG AMPL

Adjustments (used to set alarm points)	PLT (used in conjunction with PLT TEST push-button) and NODAN
Contact Load Rating	0.5A maximum, or 200 Vdc maximum resistance; Contact resistance: 0.2 ohms
Mounting	Occupies one shielded plug-in position.

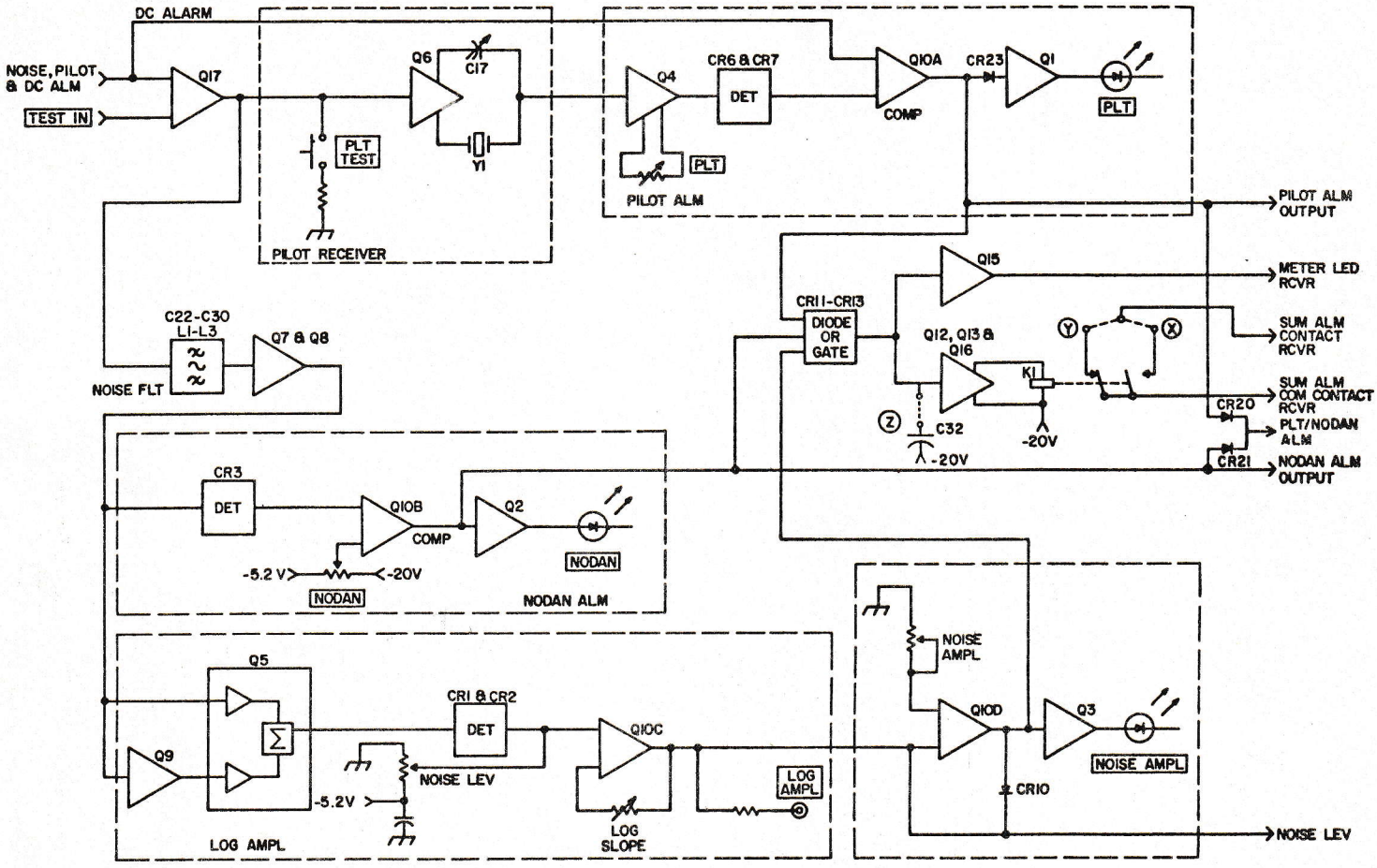

Fig. 1—Type 83150 Receiver Alarm

TECHNICAL INFORMATION

TYPE 83160 RECEIVER CONTROL

CONTENTS PAGE

1. FUNCTION

1.01 The Type 83160 Receiver Control (RCVR CONT) unit is used on protected baseband receivers. The 83160 unit evaluates the following inputs from a receiver alarm unit in each receiver: loss of pilot, NODAN, and noise level. In addition, baseband relay status in each receiver baseband amplifier is monitored. The unit responds with appropriate baseband relay drive signals to remove the faulty receiver from service. Remote and local control features are provided with external relay contacts for customer alarm equipment.

2. CIRCUIT DESCRIPTION

GENERAL

2.01 The 83160 unit monitors the following inputs from the receiver alarm units in receivers A and B: pilot alarm, NODAN alarm, and noise level. Based upon these inputs, the 83160 unit provides control signals to operate receiver A and receiver B baseband relays. In addition, the 83160 unit provides manual and remote control signals to the receiver baseband relays. The status of the relays is also monitored. An indication is provided for the manual or remote feature. Test points are provided for monitoring the noise comparators. Refer to Table A for the technical summary.

2.02 Complete circuit detail of the RCVR CONT unit is shown in SD-83160. Fig. 1, at the end of this publication, is a simplified block diagram of the circuitry. Following is a list of the major circuit components found in the blocks of Fig. 1.

RCVR A Switch Logic: Q5A-Q5C, Q1A-Q1B and CR7-CR10.

RCVR B Switch Logic: Q4A-Q4C, Q1C-Q1D and CR1-CR4.

Remote Control Logic: Q8A-Q8D, CR39-CR42 and CR19-CR20.

Note: The following circuit description assumes that receiver A is in-service, either combined with receiver B (combining mode) or receiver B out-of-service (optimal selection mode), prior to the alarm condition, and that the function switch on the 83160 unit is in the AUTO position.

PILOT ALARM

2.03 A pilot alarm signal from the receiver alarm for receiver A enters the 83160 unit on the PLT ALM A lead and is applied to the RCVR A switch logic and to the RCVR B switch logic. The pilot alarm applied to the RCVR B switch logic will inhibit the logic and prevent switching RCVR B out-of-service for pilot alarm and noise comparison. An output from the RCVR A switch logic is applied to Q3 which forwards a control signal on the BB RLY DRIVE A lead to receiver A baseband amplifier causing receiver A to be switched out-of-service. When the relay in the baseband amplifier is de-energized, a signal on the BB RLY STATUS A lead enters the 83160 unit and is applied to the RCVR B switch logic. This also inhibits the RCVR B switch logic from responding to pilot alarm and noise comparison until receiver A is placed back in-service.

2.04 In the event that both receiver alarm units forward a simultaneous pilot alarm, RCVR A and RCVR B switch logic circuits will be inhibited and no switching will take place. RCVR A and RCVR B

switch logic units will still monitor NODAN alarm and NOISE LEV signals from both receiver alarm units and cause switching based upon these alarms.

NODAN ALARM

2.05 A NODAN alarm in receiver A enters the 83160 unit on the NODAN ALM A lead and is applied to the RCVR A switch logic. Receiver A is switched out-of-service as previously mentioned and the BB RLY STATUS A signal will inhibit the RCVR B switch logic from responding to pilot alarm and noise comparison.

2.06 In the event that both receiver alarm units forward a NODAN alarm (loss of received signal on both receivers) to the 83160 unit, both receivers will be switched out-of-service. This prevents noise from being applied to any succeeding equipment.

2.07 If receiver A has been switched out-of-service for any alarm other than a NODAN alarm and the receiver alarm unit for receiver B forwards a NODAN alarm to the RCVR CONT unit, receiver B will be switched out-of-service. The BB RLY STATUS B signal, applied to the RCVR A switch logic, causes receiver A to be switched in-service.

NOISE COMPARATORS

2.08 The NOISE LEV signals from the receiver alarm units are monitored in noise comparators Q10 (receiver A) and Q9 (receiver B). These comparators can be strapped for combining mode operation (strap Q in-place) or optimal selection mode operation (no strap Q). Test points COMP A and COMB B are used to check the dc status at the output of the noise comparators.

A. Combining Mode

2.09 When combining mode operation is required (strap Q in-place), each noise comparator sees its own receiver as the quietest and both receivers are in-service and connected to the baseband interface unit. However, if the signal on the NOISE LEV A lead into the unit is a nominal 6 dB or greater than the signal on the NOISE LEV B lead, the noise comparator for receiver A will forward an alarm signal to the RCVR A switch logic causing receiver A to be switched out-of-service. When the noise difference between the signals on the NOISE LEV A and NOISE LEV B leads is a nominal 3 dB or less, combining will again take place.

B. Optimal Selection Mode

2.10 When the noise comparators have no strap Q, the unit operates in the optimal selection mode and only one receiver at a time is connected to the baseband interface unit.

2.11 The following description covers the condition of receiver A in-service. With receiver A in-service, receiver B's noise comparator is applying an alarm to RCVR B switch logic holding receiver B out-of-service. If the signal on the NOISE LEV A lead is a nominal 3 dB or greater than the signal on the NOISE LEV B lead, receiver A's noise comparator will forward an alarm to RCVR A switch logic causing receiver A to be switched out-of-service. At the same time, receiver B's noise comparator will forward a no-alarm condition to RCVR B switch logic causing receiver B to be switched in-service. This condition will remain until the signal on the NOISE LEV B lead is a nominal 3 dB or greater than the signal on the NOISE LEV A lead.

C. Remote Control

2.12 In addition to automatic switching of receivers, a remote control feature is provided and will override automatic switching on alarms but not manual switching.

Caution: To prevent a possible service outage, ensure that the selected receiver is not in alarm prior to the remote selection. The switch on the 83160 unit must be in auto to allow remote control.

2.13 The following describes remote selection of receiver A in-service. The remote command enters the 83160 unit on the SET A ON lead and is applied to the remote control logic causing two outputs to change state. One output is applied to the RCVR B switch logic and the other to the RCVR A switch logic.

2.14 If the receivers are operating in the combining mode, the RCVR B switch logic will cause receiver B to be switched out-of-service and inhibit any automatic switching to receiver B. The RCVR A switch logic will prevent any alarms on receiver A from switching receiver A out-of-service.

2.15 If the receivers are operating in the optimal selection mode and receiver A is in-service, no switching will occur and the RCVR A and RCVR B switch logic circuits will prevent automatic switching on alarms. If receiver B is in-service, it will be switched out-of-service, receiver A will be switched in-service, and the logic circuits will prevent automatic switching on alarms.

2.16 One output from the remote control logic is also applied to the lock alarm drive causing the relay to energize and light the LOCK ALM indicator. Form A or form B relay contacts are provided, depending on strap option X or Y, for external customer alarm equipment.

2.17 To remove the remote command, a reset signal, either from a remote location or from the RESET pushbutton on the 83160 unit, is applied to the remote control logic causing the SET A ON outputs to return to normal states. This removes the automatic switching inhibits on the RCVR A and RCVR B switch logic circuits and allows the receivers to return to optimal selection or combining mode operation. The LOCK ALM indicator will extinguish and the relay will de-energize.

D. Manual Control

2.18 A switch on the 83160 unit is provided to manually select one receiver in-service while holding the other receiver out-of-service for testing. The manual control will override automatic and remote switching commands.

Caution: To prevent a possible service outage, ensure that the selected receiver is not in alarm prior to operating the function switch.

2.19 The following describes manual selection of receiver A in-service. Positioning the switch to A ON TEST B, applies a negative voltage to BB RLY DRIVER A (Q3) biasing it on to hold the relay in the baseband amplifier for receiver A energized. At the same time, a ground is applied to BB RLY DRIVER B (Q2) biasing it off to hold the relay in the baseband amplifier for receiver B de-energized. A ground is also applied to the output of the logic alarm drive circuit causing the relay to energize and the LOCK ALM indicator to light. These conditions will remain in effect until the switch is placed in the AUTO position. With the switch in the AUTO position, the 83160 unit will operate as previously described.

E. Automatic Reset

2.20 When power is applied to the 83160 unit, either during initial turn-on or after a power failure or unit replacement, the remote control logic flip-flops may not be in the normal condition. When the negative voltage is first applied, the automatic reset (Q7) applies a momentary reset signal to the remote control logic clearing any remote commands. The 83160 unit will now operate as previously described.

3. REFERENCE

SD-83160 - Schematic Diagram

Table A

Technical Summary

Power Requirements	-20V (approximately)
Visual Indication	LOCK ALM
Operating Controls	
Switch Positions	B ON TEST A, A ON TEST B, and AUTO
Pushbutton	RESET
Test Points	COMP A and COMP B
Noise Comparator	
Combining Mode	Remains combined until nominal noise difference between receivers is 6 dB or more. Recombines when nominal noise difference between receivers is 3 dB or less.
Optimal Selection Mode	Switches when one receiver is about 3-dB noisier than the other.
External Relay Contacts	Form A or Form B (depending on strap option)
Contact Loading Rating	0.5A maximum or 200 Vdc maximum resistive; Contact resistance: 0.2 ohms
Mounting	Occupies one shielded plug-in position in receiver protection assembly.

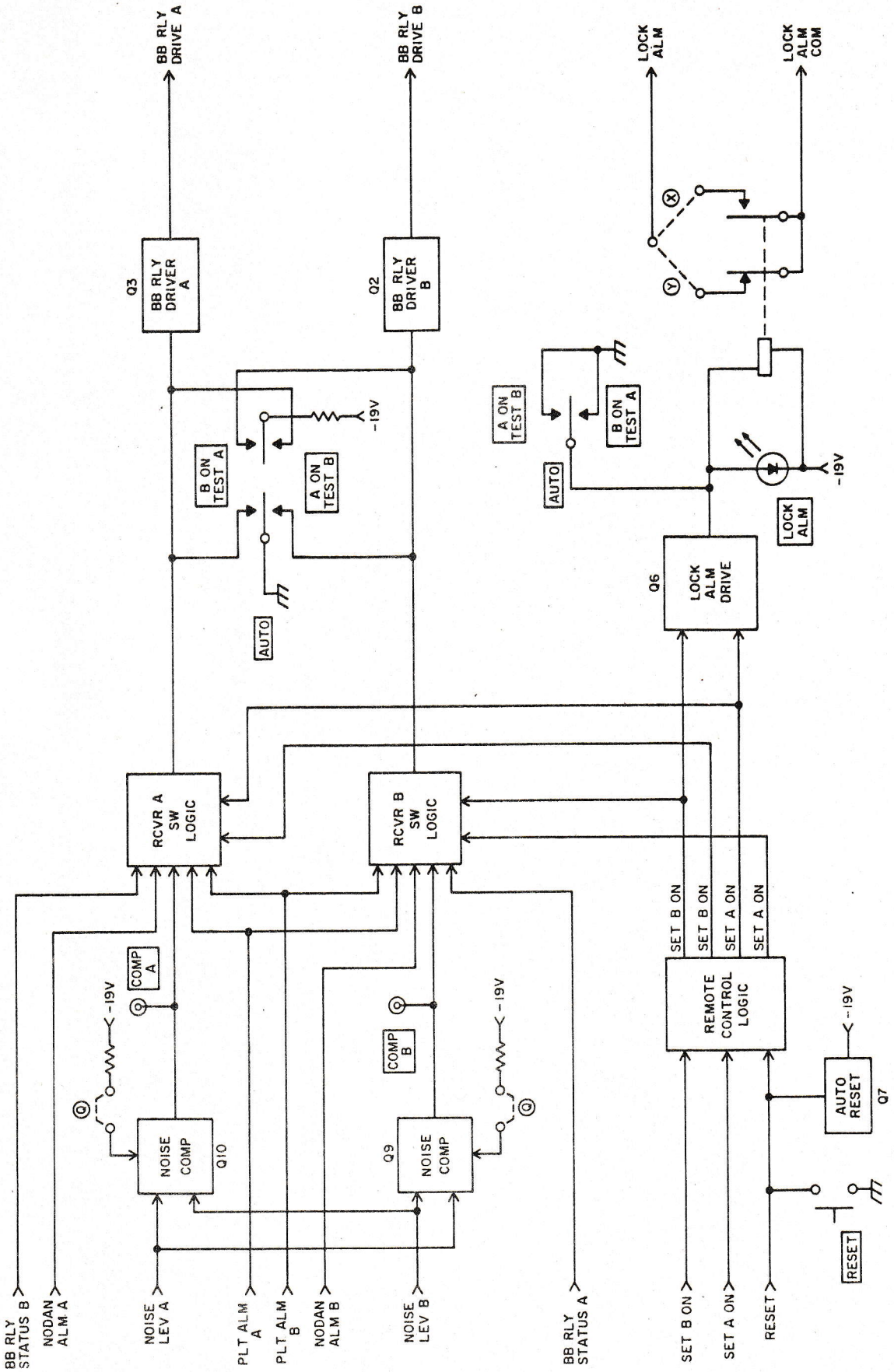

Fig. 1—Simplified Block Diagram of 83160 Unit

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TECHNICAL INFORMATION
TYPE 83167 IF FILTER EQUALIZER

REFERENCE

SD-83167 - Schematic Diagram

FUNCTION

The Type 83167 IF Filter Equalizer is used in an FL1 Microwave Radio receiver to provide flat amplitude and delay response for the IF signal as it passes from the mixer-preamplifier to the IF amplifier. The filter also serves to sharply reject any spurious signals or signals from an adjacent transmitter.

TECHNICAL SUMMARY

Input Frequency	70 MHz
Impedance (IN/OUT)	75 ohms, unbalanced
Insertion Loss (70 MHz)	
Option -001	10.0 ±0.5 dB
Option -002	18.0 ±1 dB
Return Loss (70 ±4 MHz)	22 dB, minimum
Group Delay	
67.5 to 72.5 MHz	±0.2 nanoseconds, maximum
66.5 to 73.5 MHz	±0.5 nanoseconds, maximum
Mounting	Occupies one shielded plug-in position in an FL1 receiver assembly.

GENERAL

The IF Filter Equalizer consists of a bandpass filter and a delay equalizer, with impedance correction networks on the input, output and between sections. The 70-MHz signal enters at the IN connector on the faceplate of the unit and is applied to a matching pad.

Components L2, C2 and C6 form one trap at 80 MHz and components L6, C10 and C11 form the other trap at 60 MHz. The return loss is controlled by L1, C1, L4 and C9.

A matching pad consisting of R6 and R7 is inserted between the filter and equalizer sections for isolation and impedance matching.

The delay equalizer, consisting of C3-C5, L3 and L5, is a "Bridge T" section. This provides a flat delay response by reversing the group delay effects of the bandpass filter. A "T" pad, R3-R5, brings the impedance at the OUT connector to 75 ohms.

L5 is accessible from the front panel and is part of a field adjustment procedure.

TECHNICAL INFORMATION

TYPE 83268 PILOT OSCILLATOR

CONTENTS PAGE

1. FUNCTION

1.01 The Type 83268 Pilot Oscillator is used in a microwave transmitter to generate the system continuity pilot. The 83268 unit can be strapped for continuous on or through pilot operation. The unit output is normally connected to the interface unit.

2. CIRCUIT DESCRIPTION

GENERAL

2.01 The Type 83268 Pilot Oscillator unit consists of a pilot oscillator, filter, level adjust control, monitor jack, and a pilot keying circuit. Refer to Table A for the technical summary.

PILOT OSCILLATOR

2.02 The pilot oscillator consists of NOR gates Q3A-Q3B, crystal Y1, and associated components. The pilot output signal from Q3B is coupled through C2 and the LEV ADJ control R2 which sets the pilot level. The pilot signal is then applied to the tank circuit C4 and L1 which filters the pilot signal. The pilot signal is then coupled through C3 to the output amplifier consisting of Q1 and Q2. The output of Q1 is split into two paths: one feeding the OUT jack and the other the MON -20 dB jack. Amplifier feedback stabilization is provided by a path through R5 to Q2.

PILOT KEYING

2.03 The 83268 unit can be strapped for continuous on operation (strap Y in-place) or through pilot operation (strap X in-place). (See Table B on SD-83268 for strapping applications.) For continuous on operation, Q4 is always biased off applying approximately -5.6 volts to an input of Q3A which holds the pilot oscillator on. For through pilot operation, a pilot keying input from the receiver is applied to Q4 through CR6 or CR7, Q5, and CR3. Q5 provides the necessary operating voltage levels for Q4. (For a protected assembly, two pilot keying inputs are provided.) As long as the receiver alarm unit is not reporting an alarm, as indicated by -15 to -20 volts on the input lead, Q4 is biased on applying approximately 0 volts to Q3A holding the pilot oscillator off. If the receiver alarm unit is reporting an alarm as indicated by 0 to -4 volts on the input lead, Q4 is biased off applying approximately -5.6 volts to Q3A which turns on the pilot oscillator. (At a protected assembly, an alarm from both receivers is necessary to key on this pilot oscillator.)

PILOT OSCILLATOR STATUS

2.04 A test point (TP1), to be used in conjunction with the meter panel, is provided for monitoring whether the pilot oscillator is on or off. With Q4 biased on, TP1 will indicate 0 μA (pilot oscillator off); with Q4 biased off, TP1 will indicate greater than -40 μA (pilot oscillator on).

3. REFERENCE

SD-83268 - Schematic Diagram

Table A

Technical Summary

Pilot Frequency	See Table A on SD-83268
Pilot Output Impedance	75 ohms, unbalanced
Pilot Output Level	-10 to -24 dBm (adjustable)
MON Jack Impedance	75 ohms, unbalanced
MON Jack Output Level	20 dB below Pilot Output Level
Test Point (TP1)	Assembly Meter Indication: PLT OSC OFF: 0 μA PLT OSC ON: Greater than 40 μA
Power Requirement	50 mA at -20 Vdc

TECHNICAL INFORMATION

TYPE 84201 MONITORED HOT STANDBY CONTROL

CONTENTS PAGE

1. FUNCTION

1.01 The Type 84201 MHSB Control unit performs switching in response to summed alarm inputs from the transmitters in a protected FL1-2 radio system.

2. CIRCUIT DESCRIPTION

2.01 Either transmitter can be preference strapped to serve as the normal on air transmitter. In the absence of alarm conditions, the preferenced transmitter will remain connected to the antenna. In the event of an alarm on the preferenced transmitter, the backup transmitter will be automatically placed in service, and the preferenced one removed.

2.02 There are four control inputs on the unit. Two are summed alarm inputs for automatic switching and two are external control inputs which allow remote override of the automatic switching.

2.03 Under normal conditions the two summed alarm inputs carry -15 volts. An alarm condition will raise the voltage to approximately -1V.

2.04 The preference strap causes the voltage on the appropriate comparator pin to be slightly more negative for the preferred transmitter. When pin 3 is more negative, the output on pin 6 is negative. When pin 2 is more negative, the output on pin 6 is near ground.

2.05 U1 pin 6 has 2 states: (1) approximately -15V means A in service; (2) approximately -1V means B in service. A -15 volt state at comparator pin 6 will cause Q1 to turn on, which turns Q2 off. This lights the A IN SERVICE indicator and applies a near ground voltage to relay drive pins 17/U, energizing the external coaxial relay.

2.06 When the U1 pin 6 output is -1V, Q1 turns off and Q2 turns on. This lights the B IN SERVICE indicator and applies -20V through a high impedance to relay drive pins 17/U, releasing the external coaxial relay.

2.07 The three position switch on the unit faceplate allows for either automatic operation or manual selection of Transmitter A or B to be in-service. The settings are: A ON TEST B; AUTO; and B ON TEST A. This switch overrides whatever voltages may appear at the summed alarm or external control inputs. Therefore it is possible to lock on an inoperative transmitter.

2.08 In addition to switching the transmitters, the manual switch will cause the assembly meter indicator to light, activate the lock alarm, and light the MAN CONT indicator when a transmitter is manually chosen.

3. REFERENCE

SD-84201 - Schematic Diagram

TECHNICAL INFORMATION

TYPE 84202 IF AMPLIFIER

CONTENTS PAGE

1. FUNCTION

1.01 The Type 84202 IF Amplifier, with threshold extender, is used in a microwave radio receiver to amplify a downconverted 70-MHz signal to provide one IF output and one monitor output. Additional circuitry generates an AGC sample for the meter panel. Refer to Table A for a technical summary.

2. CIRCUIT DESCRIPTION

GENERAL

2.01 The IF amplifier unit consists of a four-stage amplifier, AGC and AGC metering circuits, threshold extension circuits, and a narrow bandpass filter. A simplified block diagram is shown in Fig. 1.

IF AMPLIFIER

2.02 A 70-MHz signal enters the unit at the IN connector on the faceplate and is applied to a four-stage amplifier. Each stage consists of a dc-coupled, two-transistor amplifier with variolosser (pin diode) between stages. The output is arranged to present a level of -4 dBm at the OUT connector on the faceplate and approximately -10 dBm at the MON connector on the faceplate.

AGC DETECTOR

2.03 The gain control voltage for the IF amplifier is detected from the output of Q2 by diodes CR5 and CR6 and amplified by Q4C. The output of Q4C is applied to current amplifier Q1, when switch S1 is in the AGC position. (When the switch is in the MGC position, a voltage determined by the MGC control setting is applied to Q1.) One output of Q1 is applied to Q4D which drives the meter panel. The other output is applied to the threshold extender circuit and the variolossers (CR18, CR14, and CR7) to adjust the gain of the IF amplifier.

THRESHOLD EXTENDER

2.04 As the input level to the IF amplifier drops, the output of Q1 becomes more negative. This negative voltage is compared in Q4A to a reference set by the TH EXT control and will trigger the threshold extender circuit. The output of Q4A is applied to Q4B which turns on the TH EXT indicator, CR17, and CR15, and biases CR16 off. The 70-MHz IF signal then passes through the BP FLT to the input of Q8. This reduces the noise output of the IF amplifier.

3. REFERENCE

SD-84202 - Schematic Diagram

Table A

Technical Summary

Frequency Range	63-77 MHz
Channel Capacity Options	See Table A on schematic diagram SD-84202

Table A (Cont)

Gain	64 dB, typical
Flatness (nominal input)	±0.015 dB/MHz
AGC Range	55 dB
With Threshold Extender in Circuit (for low level inputs)	
3-dB Bandwidth	6 ±1 MHz (Option -001) or 10 ±1 MHz (Option -002)
Input	
Level	-10 dBm, maximum
Impedance	75 ohms, unbalanced
Return Loss	More than 30 dB at nominal input level
Outputs (2)	
IF Level	-4 dBm
Monitor Level	-10 ±2 dBm
Impedance	75 ohms, unbalanced
Return Loss	20 dB, minimum
Power Requirements	200 mA, maximum at -20 Vdc
Mounting	Occupies one shielded plug-in position in a receiver assembly.

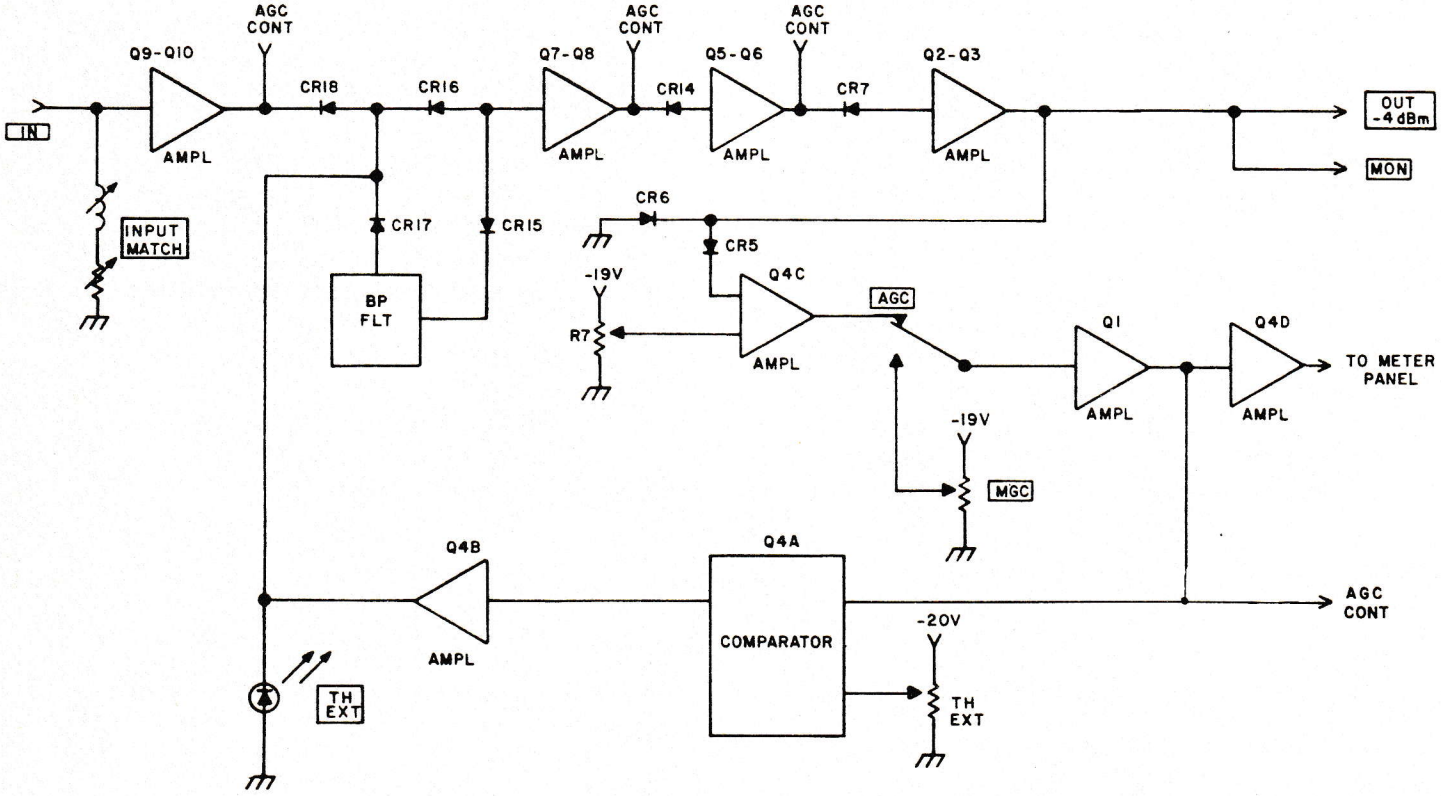


Fig. 1—Type 84202 IF Amplifier

TECHNICAL INFORMATION

TYPE 100861 TRANSMITTER ALARM

CONTENTS PAGE

1. FUNCTION

1.01 The Type 100861 Transmitter Alarm is used on a microwave radio assembly to monitor the performance of a 2-GHz transmitter. It provides alarm indications, alarm logic, and an unregulated +16V supply. Table A provides a technical summary.

2. CIRCUIT DESCRIPTION

GENERAL

2.01 The transmitter alarm monitors a sample of the baseband for pilot signal presence and strength, and checks the transmitter RF output level. The 100861 unit produces an alarm when any of the functions drops below a preset value.

2.02 Summed alarm circuitry monitors alarms from the above circuits and from an AFC alarm input. The summed alarm provides ground to light an external METER LED and dry contacts for office alarm equipment.

2.03 A test and reset circuit is included for adjustment of the alarm levels of the various paths.

PILOT ALARM

2.04 The PILOT IN input is a baseband sample from the AFC unit. It is amplified by Q7 and sent to a narrow bandpass filter, composed of FB1, Q6, Y1, and C16, which selects the pilot frequency. FB1 prevents oscillation at Q6 and helps maintain a stable pilot level. The pilot signal is amplified by U3 and U1 and rectified by CR7 and CR6. The resultant dc signal is compared in U2B with a fixed negative voltage determined by R9 and R27. Pilot degradation causes U2B to apply a positive signal to the PLT ALM output and to light the PLT indicator, DS1. Hysteresis is provided by R10.

2.05 A pilot alarm is also generated if more than one pilot is on-line. This function is provided by beat detector C6, C10, CR11, and CR12. The low frequency beat envelope is demodulated by the beat detector and the resultant dc voltage is applied to U2B which triggers a pilot alarm.

2.06 The pilot alarm level is set by R3, which controls the input to U1.

POWER OUT ALARM

2.07 The POWER DET input is a negative dc signal proportional to the transmitter RF output level. It is applied to one input of comparator U2A. The other input to U2A is a reference voltage, adjustable at R5. If the PWR DET voltage falls below a preset level, U2A sends a positive alarm signal to the LOW PWR ALM circuit.

SUMMED ALARM

2.08 The AFC ALARM IN signal and the outputs from the pilot and low power alarm circuits are OR-gated to the summary alarm circuit via diodes CR1, CR8, and CR9.

2.09 A positive alarm signal out of the OR gate diodes will bias off switch Q4 and release normally energized relay K1. (Form A or form B contacts, determined by strap option X or Y, are provided for customer alarm equipment.) The alarm will

also bias Q5 on and send a summed alarm to the MTR LED and SUM ALM output pins. Loss of the -20V input will also de-energize relay K1.

TEST

2.10 A TEST switch on the unit faceplate is used to test and adjust the alarm levels of the pilot and low power alarm circuits. It also provides a ground signal to test the AFC alarm circuit.

2.11 Depressing the switch decreases the pilot signal to Q7 and causes an alarm at U2B. Adjustment, if required, is accomplished at R3.

2.12 Depressing the switch also changes the reference voltages to comparator U2A. This causes an alarm in the low power alarm circuit. Adjustment is made, as required, at R5.

+16 VOLTS SUPPLY

2.13 Integrated circuit U5 and associated components operate as an oscillator which feeds a square-wave output to the base of Q8. This amplifier drives the bases of Q9 and Q10, which alternately charge and discharge C23. The output of C23 is rectified by CR19-CR20 and filtered by C24, C25, and L2. Unregulated +16 volts appears at the +16V OUT pin. The output voltage can be measured at test point TP1 with the radio assembly meter.

3. REFERENCE

SD-100861 - Schematic Diagram

Table A

Technical Summary

Power Requirements	90 mA at -20V, nominal
LED Indicators (red)	PLT, LOW PWR, and AFC
Alarm Trigger Levels	
PLT INPUT	9 dB below normal level or pilot beat signal
PWR OUT	3 dB decrease from normal RF level
AFC ALM	From AFC unit
Output Voltages	
Supply	+16V, unregulated
Alarm Logic	Normal: -17V or less (no load) Alarm: +0.8V to -1.5V (no load)
Relay Contact	For alarm contacts:
10 VA or 0.250A maximum or 100 Vdc maximum (resistive)	Normally open: Strap X Normally closed: Strap Y
Mounting	Occupies one shielded plug-in position in a baseband shelf.

TECHNICAL INFORMATION

TYPE 101275 POWER SUPPLY ASSEMBLY

CONTENTS PAGE

1. FUNCTION

1.01 The Type 101275 Power Supply Assembly provides battery regulation, distribution, and fusing for an FL1-2 Microwave Radio System.

2. CIRCUIT DESCRIPTION

2.01 The -21 to -28V battery inputs, A and B, enter via TB1 and pass through separate fuses and switches to pin 1 of regulator connectors J1, J3, J5, and J7. The A battery also connects to pin 15 of J4 to provide power for a coaxial relay when a monitored hot standby system is equipped with coaxial RF switches.

2.02 The regulator outputs appear on pin 3 of J1, J3, J5, and J7. The -20 volt regulator outputs are fused and distributed to J4 and J8.

2.03 The -23 volt regulator outputs connect to pin 2 of J2 and J6.

2.04 All fuse alarms are summed and drive a common fuse alarm LED, DS1. Isolated monitor jacks are provided on all regulator outputs.

3. REFERENCE

SD-101275 - Schematic Diagram

TECHNICAL INFORMATION

TYPE 101282 VOLTAGE REGULATOR

CONTENTS PAGE

1. FUNCTION

1.01 The Type 101282 Voltage Regulator provides -20 and -23 volt regulated supplies for an FL1-2 microwave radio system.

2. CIRCUIT DESCRIPTION

2.01 A -21 to -28 volt source enters at pin 1 of P1. Zener diode CR2 protects the regulator from voltage transients. Q1 is a Darlington transistor connected as a series-pass regulator. A sample of the output voltage from divider CR3, R4, R5, and CR4 is fed back to Q1 through Q2 and Q3 to maintain a constant output voltage. Output voltage is set by adjusting potentiometer R5.

2.02 Q1 output connects to the regulator output at pin 3 of P1. Another Zener diode, CR1, prevents the output from exceeding 25 volts if the regulator should fail.

3. REFERENCE

SD-101282 - Schematic Diagram

TECHNICAL INFORMATION

TYPE 15127-M3 4–WAY, 4–WIRE BRIDGE

REFERENCE

SD-15127-M3 – Schematic Diagram

FUNCTION

The Type 15127-M3 4-Way, 4-Wire Bridge interconnects four 4–wire circuits, providing HF bridging and branching facilities for radio basebands and multiplex equipment.

TECHNICAL SUMMARY

Transmission Loss (Input Leg to Non-associated Output Leg, 100 kHz ref.)	15.4 ±0.3 dB
Isolation Loss (Input Leg to Associated Output Leg)	86 dB minimum (300 Hz – 1.8 MHz)] Bridge Only
	80 dB minimum (1.8 MHz – 3 MHz)] Bridge Only
Impedance	75 ohms
Return Loss	
300 Hz	11 dB minimum
1000 Hz	18 dB minimum
4000 Hz to 2.4 MHz	20 dB minimum
3 MHz	18 dB minimum
Frequency Response	
300 Hz	–1.0 dB
1.0 kHz	–0.25 dB
4.0 kHz	0.00 to 0.15 dB
100 kHz (ref.)	0.00 dB
1.5 MHz	–0.25 dB
3.0 MHz	–0.60 dB
Input Level (300-channel loading)	–15 dBm per-channel test tone –8 dBm0 data Loading (420 channels)

Operating Ambient Temperature Range	−10 to +60° C (+14 to +140° F)
Mounting	Occupies 1 mounting space on standard 19−inch equipment rack and projects 5 inches from rack faces. (1−3/4" high, 9−1/2" deep)
Weight	3 lbs., 5 oz.

CIRCUIT DESCRIPTION

A. General

The Type 15127-M3 4−Way, 4−Wire Bridge panel is equipped with impedance-matching transformers which allow the bridge to be used on 75-ohm lines. The bridge and transformers are mounted on a printed-circuit board, which is enclosed in an aluminum wrapper and cover that occupies one rack mounting space. Connections to external 75−ohm circuits are made to BNC jacks at the rear of the panel.

B. 4−Way 4−Wire Bridge

The 4−way 4−wire bridge is a passive network which interconnects four 4−wire circuits to provide HF bridging facilities. This type of operation requires fulfillment of three conditions: (1) each input leg must be connected to all non-associated output legs, (2) each input leg must be isolated from all other input legs, and (3)each input leg must be isolated from its associated output leg.

All resistors in the bridge are of equal value and are matched sets. Also notice that there are phase reversals through the bridge, as shown by Note 3 on SD-15127-M3.

1. Input Transmitted to Non-Associated Outputs

A signal applied to LEG 1 IN passes through R23 and R24 to LEG 2 OUT, R19 and R20 to LEG 3 OUT, and R13 and R16 to LEG 4 OUT. These circuit paths form a bridge with LEG 1 IN connected across two corners, and LEG 2, 3 or 4 OUT connected across the other two corners. The bridge configuration allows a signal at LEG 1 IN to appear at LEG 2, 3 or 4 OUT, after being attenuated 15 dB by the bridge loss and approximately 1 dB by the two transformers. Similar bridge circuits are formed between other input legs and their non-associated output legs, satisfying condition (1) above.

2. Inputs Isolated

A signal applied to LEG 1 IN follows two paths to LEG 2 IN. One path is through R19, R20, R21 and R22; the other path is through R13, R16, R14 and R15. These circuit paths are connected out of phase, providing a high degree of transmission loss from LEG 1 IN to LEG 2 IN. (Other balanced signal paths exist between LEG 1 IN and LEG 2 IN, but they are all connected out of phase.) Similar bridge circuits are formed between any input leg and all other input legs, satisfying condition (2) above.

3. Input and Associated Output Isolated

A signal applied to LEG 1 IN follows two paths to LEG 1 OUT. One path is through R19, R20, R21, R22, R17 and R18; the other path is through R13, R16, R14, R15, R17 and R18. These circuit paths are connected out of phase as discussed above for "Inputs Isolated". Similar bridge circuits are formed between any input leg and its associated output leg, satisfying condition (3) above.

MAINTENANCE

All bridge components are factory selected in order to provide a high degree of bridge balance. Therefore, to maintain this balance, if any component needs to be replaced, return the unit to the factory for repair.

TECHNICAL INFORMATION

TYPE 19379-M2-80907 ORDER WIRE

REFERENCES

SD-19379-M2-80907 - Schematic Diagram
TI-19379-M2 - Technical Information

GENERAL

The Type 19379-M2-80907 Order Wire differs from the standard Type 19379-M2 Order Wire in that a new 2.1-kHz low-pass filter, FL3, replaces the old 2.1-kHz filter comprised of C20-C24, L3, and L4. The new filter has more stop band attenuation to prevent alarm tones from interfering with the order wire in a speech plus alarm system.

In all other respects, the 19379-M2-80907 order wire is similar to the standard 19379-M2 order wire and is described in TI-19379-M2.

TECHNICAL INFORMATION

TYPE 19379-M2 ORDER WIRE

CONTENTS PAGE

1. FUNCTION

1.01 The Type 19379-M2 Order Wire unit provides transmit, receive, and auxiliary channel access to the radio baseband. Equipment options include an auxiliary channel bandpass filter, a line amplifier and matching card, a signaling card, and a -48 Vdc voltage regulator.

2. CIRCUIT DESCRIPTION

A. General

2.01 A technical summary of the order wire unit is contained in Table A. Refer to Fig. 1 for a simplified block diagram of the unit.

B. Transmit Order Wire

2.02 Voice frequency signals enter the unit at J8, HANDSET, and pass through limiter diodes CR1 and CR2 to a low pass filter composed of inductors L1 and L2 and capacitors C8 through C12. This filter suppresses signal components above 4 kHz. Extension handset signals enter the unit at J10 and are applied to the limiter and the filter with the handset signals. The output of the filter is applied to amplifiers Q2 and Q1 and leaves the unit at the low impedance TRANSMIT outputs J4 through J7. Signaling tone signals, if equipped, are applied at the input of Q2.

2.03 Auxiliary input signals enter the unit at AUX INPUT, J10, and pass through optional bandpass filter FL1 to the input of amplifier Q1. A strapping arrangement allows local monitoring of the AUX INPUT signals.

C. Receive Order Wire

2.04 Order wire signals enter the unit at J1 through J3, RECEIVE, and are amplified by IC's U1B and U1A. These amplifiers have an associated network to reduce their frequency response above 12 kHz. The output of the amplifiers, at U1A, is fed to an AUX OUT output, to the optional signaling card, and to the order wire receive circuits.

2.05 The order wire receive signal is applied to a filter composed of capacitors C20 through C24 and inductors L3 and L4. The filter passes signals below 2.1 kHz to amplifier U2B. SPEAKER LEVEL potentiometer R42 sets the level of U2B's output which passes to HANDSET jack J9, the extension handset output on J10, and to speaker amplifier Q4. This amplifier operates as a modified class A amplifier, with its bias current determined by the magnitude of the drive signal. Diodes CR3 and CR4 rectify the output of Q4 and apply this signal to amplifier U2A. The output of U2A is applied to bias control Q3, which maintains the operating point of Q4, while requiring low current when no signal is present.

D. Line Amplifier and Matching Card

2.06 Transmit signals from the J6 output of the order wire unit are applied to the card at connector P1. The card input signal passes through XMT LEV potentiometer R31 to push-pull amplifier Q2A and Q2B. The amplifier outputs are adjustable in impedance through option strapping to match the baseband impedance at connector J11.

2.07 Receive order wire signals from a baseband source enter the card at J11

and pass through amplifiers Q1A and Q1B. Option straps adjust the amplifier input impedance to match the baseband, and additional option straps set the amplifier receive level to a specific range. Potentiometer R1, RCV LEV, provides fine adjustment of the output signal level, which is applied to the order wire unit at J3. The output of the card can be monitored at test points TP1 and TP2.

2.08 Voltage regulator Q3 receives -24 Vdc from the order wire unit and provides a -18 Vdc output for the card.

E. Signaling Card

2.09 The signaling card contains an oscillator, a signaling tone receiver, and a side tone generator. The oscillator is activated by depressing SIGNALING switch S1, or by grounding the remote signaling input of J10. This turns on oscillator U2A through FET switch Q2. The signaling tone is passed through an RC filter composed of resistors R1 and R9 and capacitor C1 to the transmit order wire circuit.

2.10 The signaling tone output of U2A is rectified by diodes CR1 and CR2 and is applied to comparator U1A through a time delay network composed of capacitor C5 and resistor R10. The time delay network delays side tone by an interval that allows the distant receiver to detect the signal. The output of U1A reverse biases diode CR3 to turn on side tone generator U2B, applying an audible signal to the speaker and handset outputs.

2.11 Receive signals from U1A of the order wire unit are applied to the signaling card at the input of level control R34 and pass to signaling tone detector U1B. The sensitivity and frequency of the signaling tone detector are factory set. The output of U1B is rectified, amplified, and applied to relay driver Q1 and to U1A. The relay driver operates relay K1 to provide Form C contact closure to external equipment. The output of U1A reverse biases CR3 and turns on the side tone generator.

2.12 Regulator U4 receives a nominal -24 Vdc from the order wire unit and produces -18 Vdc for the signaling card.

F. Input Voltages

2.13 Supply voltages of -24 or -48 Vdc enter the unit at terminal block TP1, NEG BATT, and are applied through fuse F1 to a strapping arrangement. The -24V supply is returned to the unit through the strap; the -48V supply is passed through optional voltage regulator Q201 before being applied to the strap. The regulator will accept any voltage between -23 and -56 Vdc.

3. REFERENCE

SD-19379-M2 - Schematic Diagram

Table A

Technical Summary

Input/Output Characteristics	
Frequency	300 Hz to 12 kHz
Impedance	75 ohms, unbalanced
Level	-25 dBm
Return Loss	26 dB, minimum, 300 Hz to 7.6 MHz
Input/Output Isolation	35 dB, minimum, 300 Hz to 7.6 MHz
Auxiliary Input/Output Characteristics	
Frequency Response	w/o filter: 300 Hz to 1 kHz, -3, +0.5 dB (1 kHz ref); 1 kHz to 12 kHz, ±0.5 dB (8 kHz ref).
	w/filter: 4.4 kHz to 6.9 kHz, ±0.5 dB

Impedance	600 ohms, unbalanced
Input Level	0 dBm ±1.0 dB (8 kHz ref)
Output Level	-10 dBm ±1.0 (8 kHz ref)
Line Amplifier and Matching Card Characteristics	
Input/Output Frequency	300 Hz to 12 kHz
Impedance	
Transmit Input/Receive Output (toward Order Wire)	Connects to orderwire (high impedance)
Transmit Output/Receive Input (toward Baseband)	75 ohms, unbalanced, or 150 or 600 ohms, balanced
Level	
Transmit Input/Receive Output (toward Order Wire)	-25 dBm
Transmit Output (toward Baseband)	
75 ohms, unbal	-9.5 to -35 dBm
150 ohms, bal	-9.5 to -35 dBm
600 ohms, bal	0 to -35 dBm
Receive Input (from Baseband)	
75 ohms, unbal	0 to -47 dBm
150 ohms, bal	0 to -47 dBm
600 ohms, bal	+7 to -47 dBm
Signaling Card Characteristics	
Frequency	1800 Hz or 2600 Hz
Harmonics	-70 dBm0, or lower
Receive Sensitivity	0 to -20 dBm0
Output Level	-6 to -16 dBm0
Operating Ambient Temperature Range	0° to +50°C (+32° to +122°F)
Power Requirements (at -24 Vdc)	
Idle: w/o options	40 mA
w/signaling only	75 mA
2/line ampl only	52 mA
Maximum, all options	237 mA
Weight	1.8 kg (4 lb), approximately
Mounting	Occupies two spaces in a standard 483 mm (19-in) equipment rack.

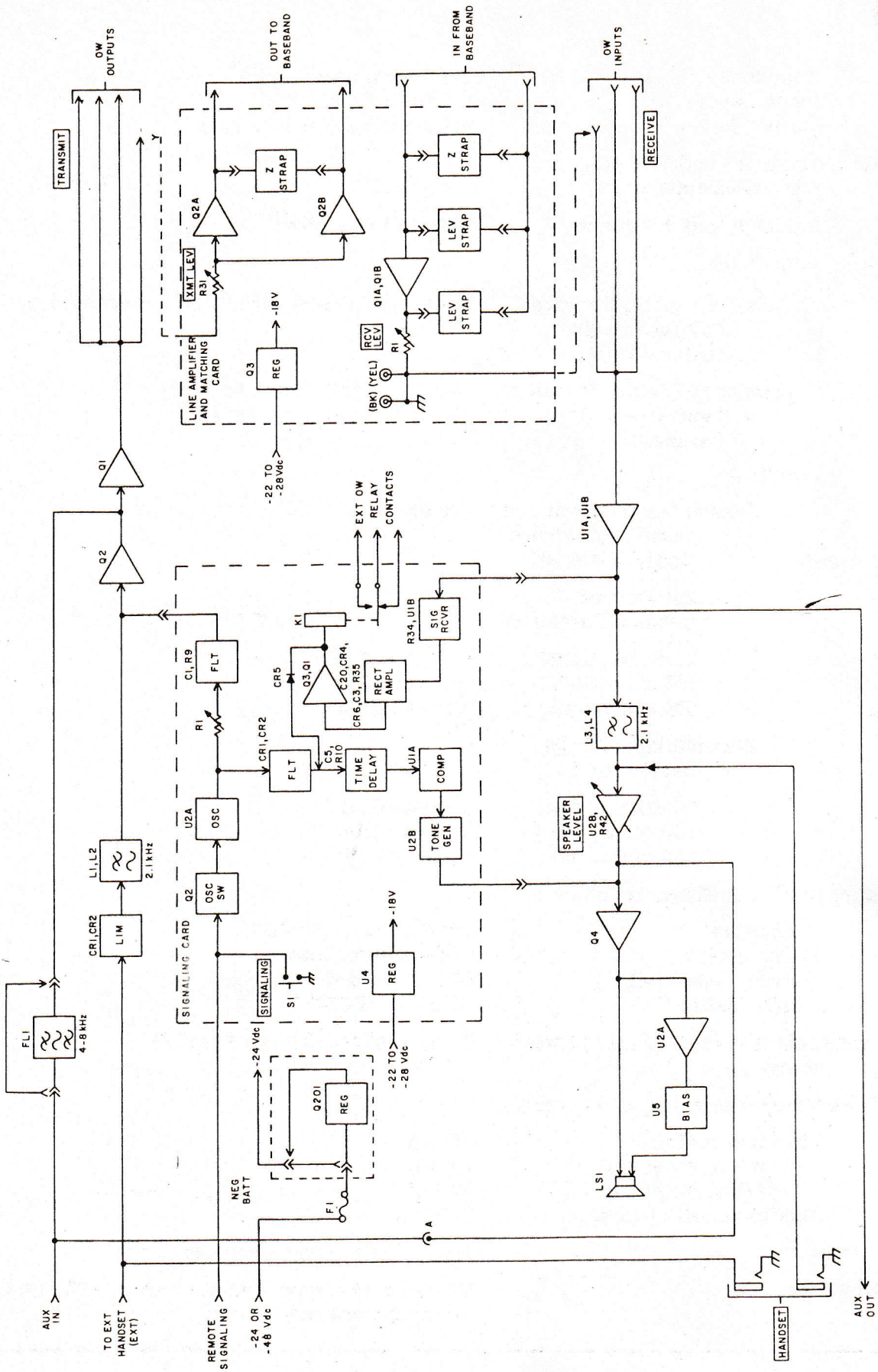
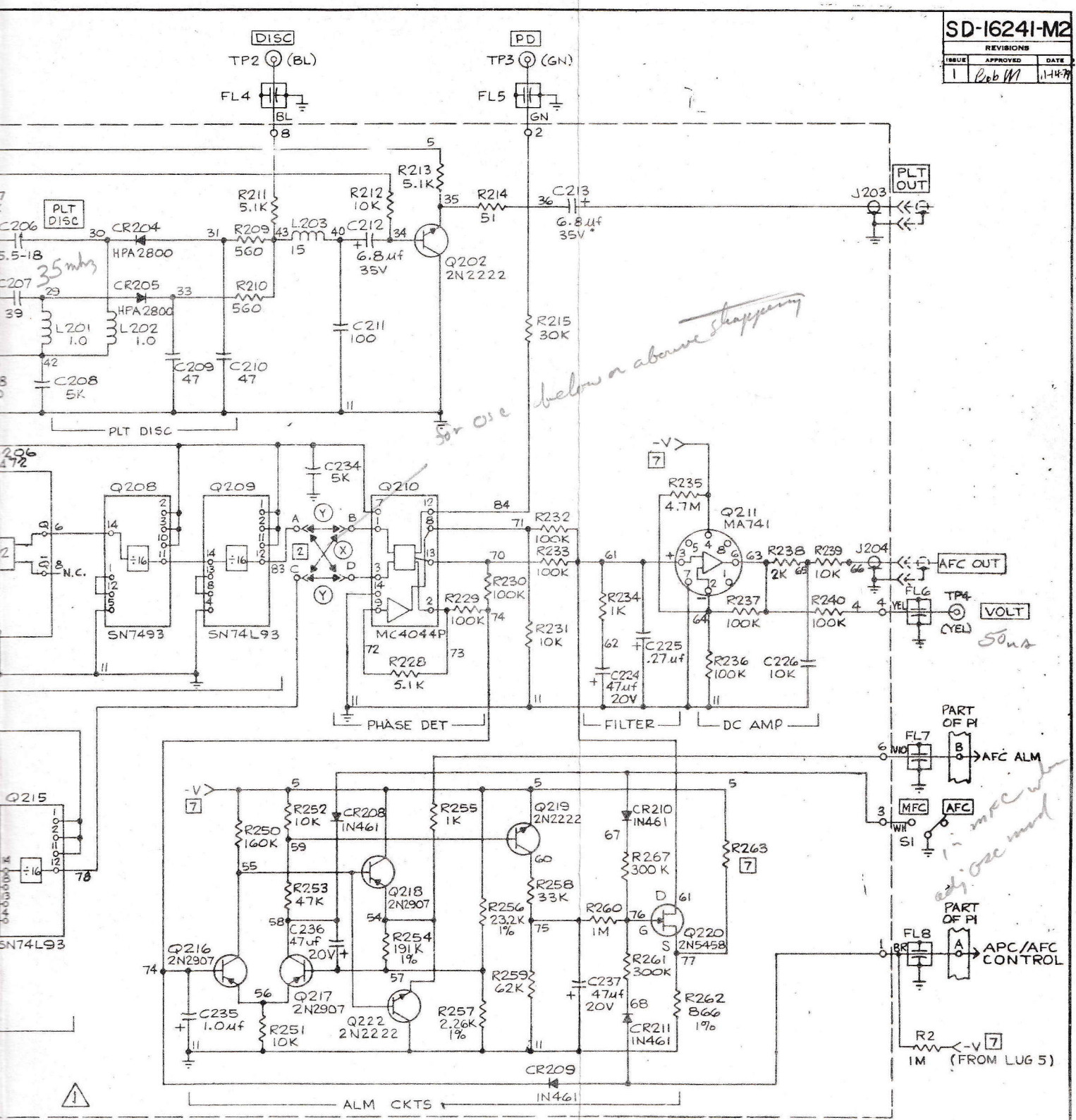


Fig. 1—Block Diagram of Order Wire Unit



SYM	DESCRIPTION
△	DENOTES CIRCUIT BOARD ISSUE NO.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—●—	DENOTES CIRCUIT JUNCTION POINT

LEGEND

ING GE	R263	AFC CARD
V	5.62K	021-016382-001
V	5.36K	021-016382-002

LAST NUMBERS USED

S1, FL8, TP4, R1, P1, R269, Y201, C238, CR211, L206, Q222, J206,

ISSUE NO. CROSS REFERENCE

SD	1
TI	1

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .003"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: FM2000/FLI-2

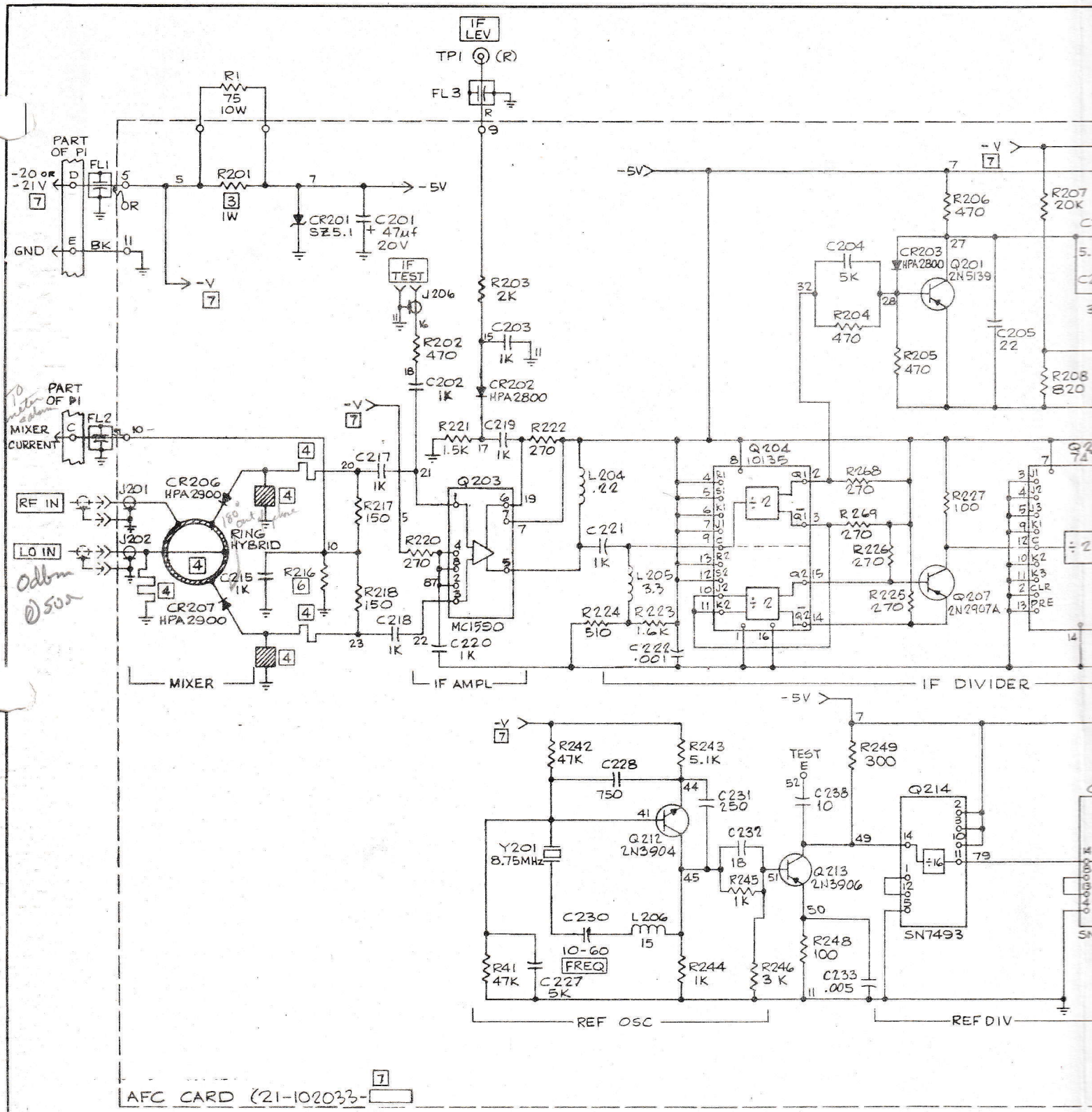
SCALE —— ENGR. BY J B APP'VD.
DATE 12-9-71 DRAWN BY DT APP'VD.

Farinon

AFC

ORIG. FS
DIST. R
SHEET 1 OF 1 SHEETS
DWG. SIZE D

SD-16241-M2



AFC CARD 621-102033-[7]

[7] EQUIPMENT OPTIONS ARE PER TABLE B.

[6] FACTORY SELECTED COMPONENT. NOMINAL VALUES: R216-51Ω.

5. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

[4] PART OF PRINTED CIRCUIT BOARD.

[3] R201 IS FACTORY SELECTED, NORMALLY NOT EQUIPPED.

[2] WIRING OPTIONS ARE PER TABLE A.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ±5%, 1/4W, AND CAPACITOR VALUES ARE IN PICOFARADS. INDUCTOR VALUES ARE IN MICROHENRIES.

NOTES:

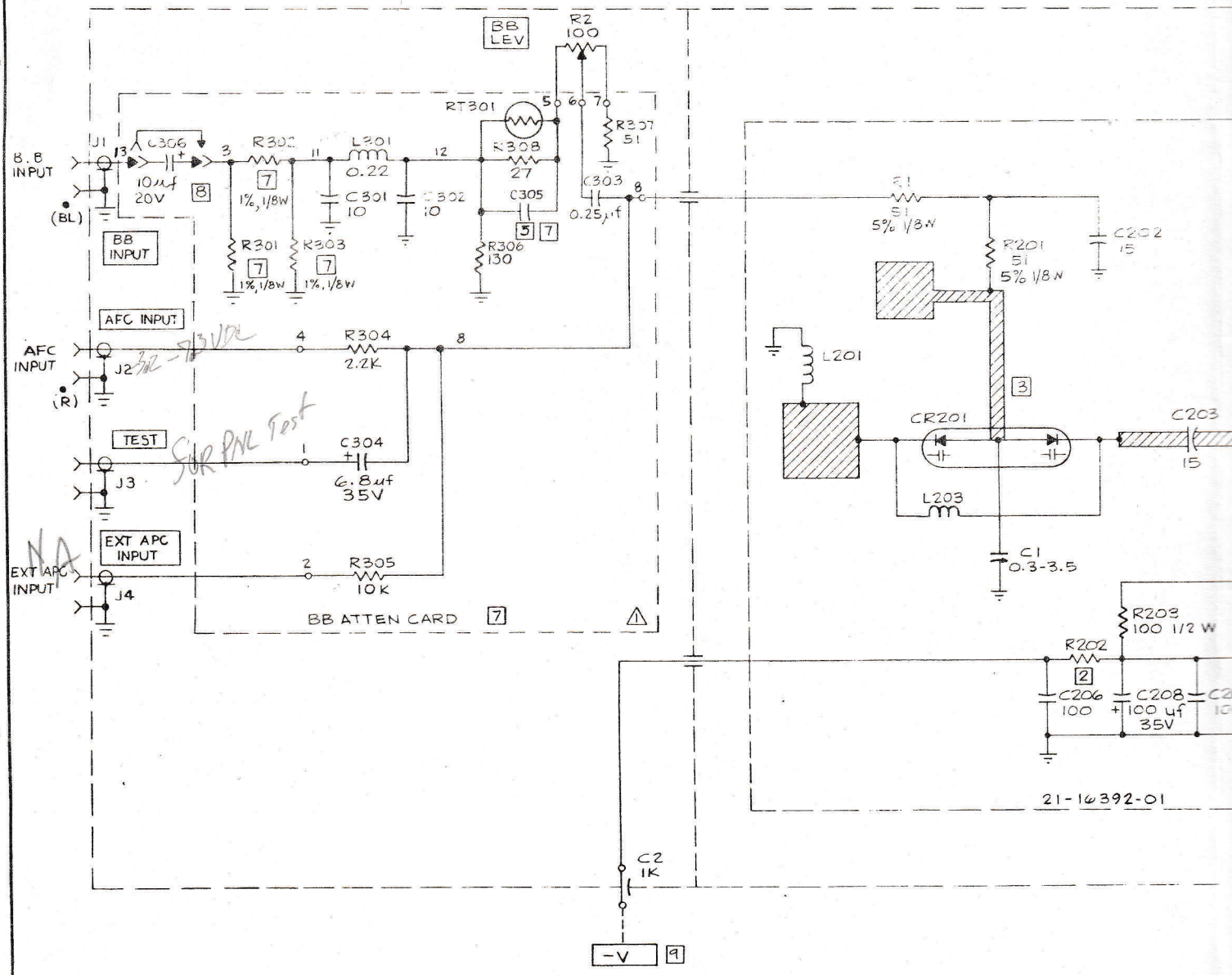
TABLE A [2]

OPTION	DESCRIPTION
X	L.O. BELOW RF FREQ.
Y	L.O. ABOVE RF FREQ.

TABLE B

OPTION	APPLICATION	OPERATING VOLTAGE
001	FM2000	-21V
002	FL1-2	-20V

SD-16241-M2



OPT.	APPLICATION	BB ATTEN CARD
001	FM2 WITH OLD BB SHELF	021-017140-001
002	FM2 WITH NEW BB SHELF	021-101458-001
003	FL1-2	021-101458-001

[9] SEE TABLE A FOR PROPER SUPPLY VOLTAGE.

[8] C306 EQUIPPED ONLY ON 021-101458 BB ATTENUATION CARD.

[7] EQUIPMENT OPTIONS ARE PER TABLE A.

6. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

[5] FACTORY SELECTED COMPONENT. NOMINAL VALUE GIVEN IN TABLE A.

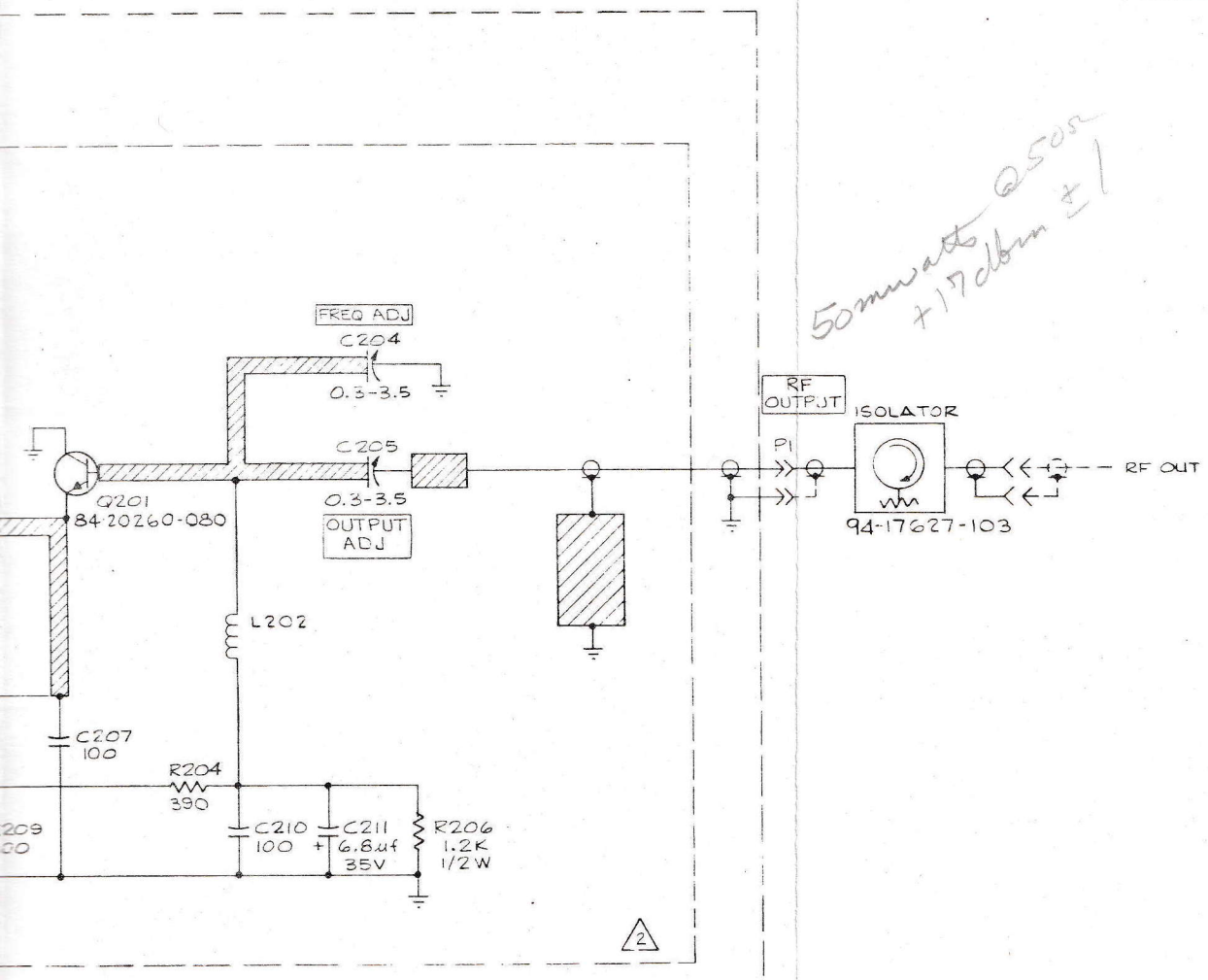
[4] R301, 302, 303 VALUES SHOWN ARE NOMINAL.

[3] SHADED AREAS REPRESENT MICROSTRIP CIRCUITRY WHICH IS PART OF PRINTED CIRCUIT BOARD.

[2] R202 IS FACTORY SELECTED FOR 50 MW OUTPUT. (NOT LESS THAN 47 NOR MORE THAN 130Ω).

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS, ±5%, 1/4W; AND CAPACITOR VALUES ARE IN PICOFARADS. INDUCTOR VALUES ARE IN MICROHENRIES.

NOTES:



RLE A [7] [5]

ID	R301, 303 [4]	R302 [4]	C305 (NOM)	SUPPLY (-V) [9]
01	294	40.2	3970 pF	-21
01	182	73.2	NORMALLY NOT EQPD	-21
01	182	73.2	NORMALLY NOT EQPD	-20

C206,7,9,10 WERE 120. ECN 7117.

16	Mita P.	3/27 80

SD-16243

REVISIONS

ISSUE	APPROVED	DATE
1		3-6 72
COMPS ON BB ATTEN CARD WERE PT TO PT WIRED. (COMPS RE-NUMBERED). R301 & R303 WERE 174, R302 WAS 78.7, J4&R305 ADDED. R1&C1 WERE R6&C6, R304 WAS 2K. ECN 1415.		
2		5/12 72
NOTE 4 ADDED. ECN 1651.		
3		9/27 72
DELETED R205, 100Ω, WAS ACROSS WITH L202, 87-17627-103 WAS 87-16578-803. R203, R204 & C208 WERE 100, 390 & 100 µF. ECN 1678.		
4		10/24 72
R203 WAS 150, R204 WAS 470. ECN 1803.		
5		2/20 73
C305 ADDED. ECN 2017.		
6		8/14 73
R301 & 303 WERE 243 NOM, R302 WAS 51.1 NOM. ECN 2050.		
7		10/17 73
R301 & 303 WERE 174 NOM, R302 WAS 78.7 NOM. ECN 3437.		
8		8/25 75
Q201 WAS 84-20115-154. ECN 6283.		
9		8/17 78
OPTION 002 ADDED. ECN 6313.		
10		9/15 78
R301 & 303 WERE 294 NOM, R302 WAS 40.2. ECN 6477.		
11		12/20 78
OPT. 002 C305 WAS 3970 pF. ECN 6542.		
12		3/20 79
OPT. 003 ADDED. (WAS P/O OPT 003). ECN 6672.		
13		5/7 79
L203 WAS 071-17069-003, (SEE PL). ECN 6753.		
14		6/6 79
16392 PC WAS ISS. 1. (MECH. CHG). ECN 6969.		
15	Mita P.	11/2 79

LAST NUMBERS USED

R2, R206, R306, L203, C306
C2, C211, RT301, Q201, CR201

ISSUE NUMBER CROSS REFERENCE

SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
TI	1	2	2	2	2	2	2	2	2	2	3	3	4	4	4	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
3 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
2 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: FM 2000 / FL.-2

△ DENOTES CIRCUIT BOARD ISSUE NO.
DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES
DENOTES CIRCUIT JUNCTION POINT
SYM. DESCRIPTION
LEGEND

SCALE — ENGR. BY RWB APP'VD.
DATE 7-11-71 DRAWN BY DT APP'VD.

Farinon

OSCILLATOR-MODULATOR (1.85-2.0 GHz)

ORIG. EE SHEET OF SHEETS
DIST. B

SD-16243 D

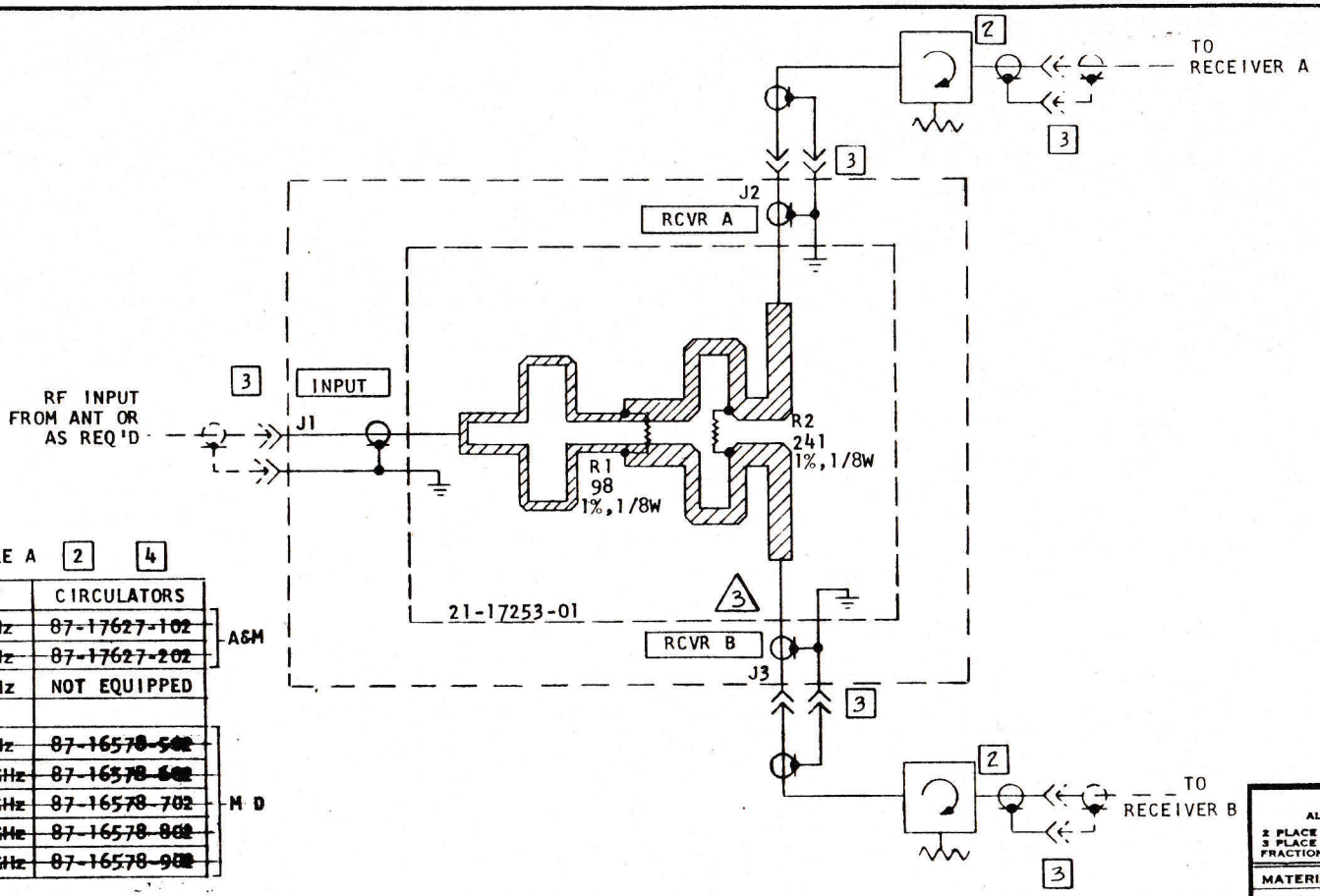


TABLE A [2] [4]

OPTION	FREQUENCY	CIRCULATORS	
~~-01~~	~~1.7-2.0 GHz~~	~~87-17627-102~~	A&M
~~-02~~	~~2.0-2.3 GHz~~	~~87-17627-202~~	A&M
-03	1.7-2.3 GHz	NOT EQUIPPED	
-04			
~~-05~~	~~2.1-2.2 GHz~~	~~87-16578-502~~	M D
~~-06~~	~~2.15-2.3 GHz~~	~~87-16578-602~~	M D
~~-07~~	~~2.0-2.15 GHz~~	~~87-16578-702~~	M D
~~-08~~	~~1.85-2.0 GHz~~	~~87-16578-802~~	M D
~~-09~~	~~1.7-1.85 GHz~~	~~87-16578-902~~	M D

[4] WITH OPTION 03, CONNECTIONS TO RCVR A & B ARE MADE DIRECTLY TO J2 & J3.

[3] SMA CONNECTORS.

[2.] EQUIPMENT OPTIONS ARE PER TABLE A

1. SHADED AREAS REPRESENT MICROSTRIP CIRCUITRY WHICH IS PART OF PRINTED CIRCUIT BOARD.

NOTE:

TABLE B

INPUT RETURN ~~LOSS~~	INSERTION LOSS	INPUT/OUTPUT Z
12 dB	4 dB (TOTAL)	50 OHMS

SD-16247

REVISIONS

ISSUE	APPROVED	DATE
1	EEn	5/11 72
CKT BD WAS ISS 1. ECN 1469.		
2		6/22 72
CIRCULATORS, TBL A AND NOTE 2 ADDED. ECN 1564.		
3		8/2 72
ADDED OPTS. -01 & -02 A&M OPTS -05 THRU -09. ECN 1739.		
4	Sal	11/29 72
OPT. 01 & 02 RTD A&M. OPT 03 & TBL B ADDED. ECN 2845.		
5		10/10 74
PC BD WAS ISS. 2. (MECH CHG). ECN 4993.		
6		4/7 77

TI NOT REQUIRED

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64"
ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .002"

MATERIAL:
FINISH:
PROCESS:
USED ON: 16274 (FM2000)

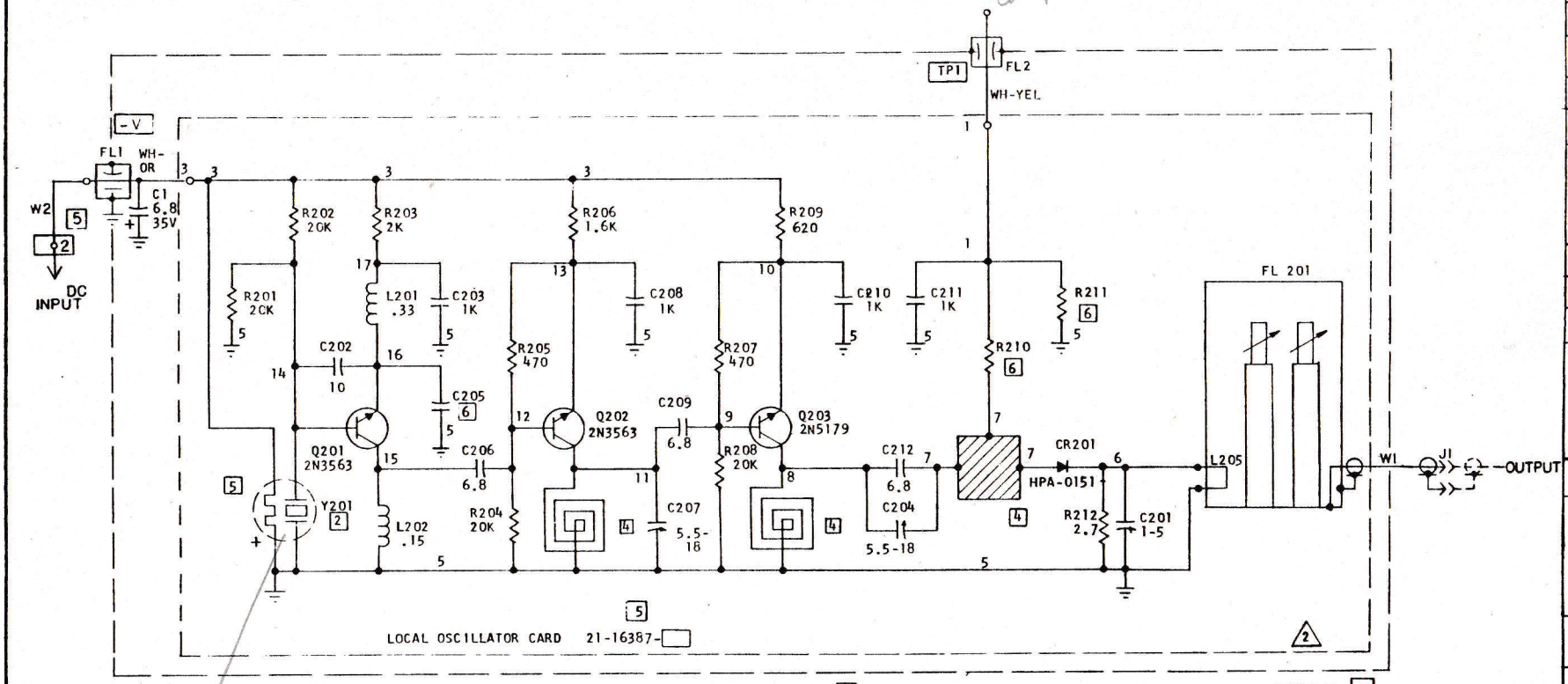
SCALE -	ENGR. BY SG	APP'VD. RF
DATE 4/22/72	DRAWN BY DT	APP'VD. RK

Farinon

RF HYBRID

ORIG. DIST. | SHEET 1 OF 1 SHEETS | DWG. SIZE

SD-16247 B



Compare to test data

Not in Recr
Can use 40. in xmit & Rec
Should have heater in xmit.

TABLE A [2]

LOCAL OSC. FREQ.	XTAL FREQ.
BELOW CHAN. FREQ.	$\frac{fch-70}{N}$
ABOVE CHAN. FREQ.	$\frac{fch+70}{N}$

WHERE N=16, 18,20,22 AND SELECTED SO THAT XTAL FREQ IS BETWEEN 90.0 TO 100.0 MHz

TABLE B [5]

OPTION	DESCRIPTION	LOCAL OSC CARD STK NO.	USED ON	W2	DC INPUT	CRYSTAL SPEC.
001	XTAL OVEN NOT EQP'D	21-16387-01	FM2	NOT EQPD	-21V	TS086-R002
002	XTAL OVEN EQP'D	21-16387-02				TS086-R078
003	XTAL OVEN NOT EQP'D	21-16387-01	FL1-2	EQUIPPED	-20V	TS086-R002
004	XTAL OVEN EQP'D	21-16387-02				TS086-R078

LAST NUMBERS USED
R212, C212, CR201, Q203, L205.

7. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

[6.] FACTORY SELECTED COMPONENT NOMINAL VALUE: C205, 18 pF (15 pF to 27 pF RANGE); R210-2.7K, R211-10.

[5.] EQUIPMENT OPTIONS ARE PER TABLE B.

[4.] PART OF PRINTED CIRCUIT BOARD.

3. TUNING RANGE 1630-2070 MHz.

[2.] CRYSTAL FREQ FOR 50 MHz CHANNEL SPACING IS DETERMINED BY FORMULA GIVEN IN TABLE A. FOR OTHER THAN CCIR OR 50 MHz CHANNEL SPACING CONTACT ENGR. DEPT.

1. UNLESS OTHERWISE SPECIFIED, RESITOR VALUES ARE IN OHMS ±5%, 1/4 WATT, CAPACITOR VALUES ARE IN PICOFARADS AND INDUCTOR VALUES ARE IN MICROHENRIES.

NOTES:

ISSUE NO. CROSS REFERENCE

SD	1	2	3	4	5	6	7	8			
TI	1	1	1	1	1	1	1	1			

SYM	DESCRIPTION
△	DENOTES CIRCUIT BOARD ISSUE NO.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—•—	DENOTES CIRCUIT JUNCTION POINT

LEGEND

SD-16251

REVISIONS

ISSUE	APPROVED	DATE
1		3-3 72
C1 ADDED. ECN 1519.		
2		6/22 72
CR201 WAS HPA 0142. ECN 1949.		
3		7/23 73
R210 WAS 10K. R211 WAS 43. ECN 2220.		
4		1/8 74
"+" ADDED TO Y201. ECN 2958.		
A		12/3 74
FL2 WAS YEL TP. ECN 3497.		
5		9/22 75
Q203 WAS 2N3563. ECN 5098.		
6		5/2 77
Q202 WAS 2N5179 (ERROR). ECN-6259.		
A		7/15 78
OPTIONS 003 & 004 ADDED. ECN 6329.		
7		9/13 78
XTAL SPEC. ADDED TO TBL B. ECN 6732.		
A	Bob M	6/5 79
PC BD WAS ISS. 1. (MECH. CHG). ECN 6799.		
8	Bob M	7/11 79

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: FM2/FL1-2

SCALE	ENGR. BY	APP'VD.
DATE 11-15-71	DRAWN BY DT	APP'VD.

Farinon

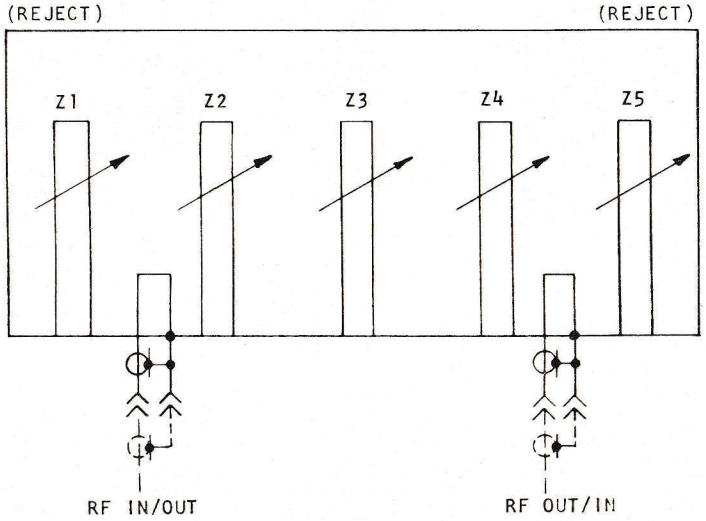
LOCAL OSCILLATOR (1.7-2.0 GHz)

ORIG. DIST. R | FE | SHEET | OF | SHEETS | DWG. SIZE

SD-16251 C

TABLE A

OPTION	TUNING RANGE	INSERTION LOSS	VSWR	IN/OUT Z
01	1.7-2.0 GHz	0.5 dB, MAX	1.25:1, MAX	50Ω NOM
02	2.0-2.3 GHz			



3. RF IN/OUT ARE SMA TYPE FEMALE COAXIAL CONNECTORS.
2. TUNING RANGE OPTION PER TABLE A.
1. THE FILTER IS FACTORY TUNED. ADJUSTMENTS SHOULD NOT BE ATTEMPTED IN THE FIELD, UNLESS SUITABLE EQUIPMENT IS AVAILABLE.

NOTE:

SD-16588

REVISIONS

ISSUE	APPROVED	DATE
1	JCF	12-16-71
ADDED I.L., VSWR & Z TO TBL A. DELETED J1, J2 REF AND REF TO T.I. ECN 2751.		
1A	RL	9/6 74
MECH. REWORK. ECN 7113.		
2	Mit. P.	3/31 80

TI NOT REQUIRED

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015"
3 PLACE DECIMALS ± .005"
FRACTIONAL DIMENSIONS ± 1/64"
ANGULAR DIMENSIONS ± 1°
HOLES UNDER .250 DIA. ± .002"

MATERIAL:
FINISH:
PROCESS:
USED ON: FR2000

SCALE NONE	ENGR. BY RF	APP'VD. JCF
DATE 8/3/71	DRAWN BY DT	APP'VD. RK

Farinon

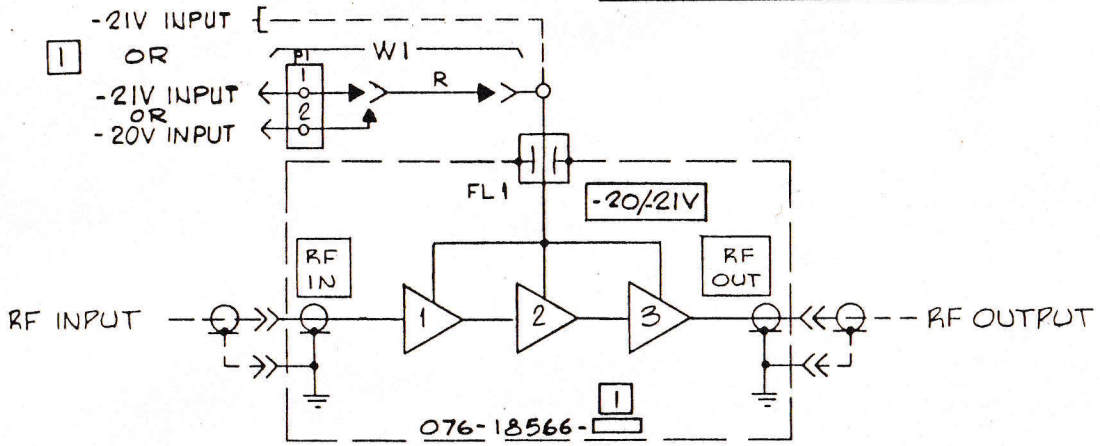
BANDPASS FILTER

ORIG. DIST. | SHEET 1 OF 1 SHEETS | DWG. SIZE

SD-16588 | B

TABLE A 1

OPT.	DESCRIPTION	NOISE FIGURE	MICROCIRCUIT
001	W1 NOT EQUIPPED (-21V CONNECTION DIRECTLY TO FL1)	5.5 dB MAX.	076-18566-001
002	W1 EQUIPPED (-21V THRU P1-1)	5.5 dB MAX.	076-18566-001
003	W1 EQUIPPED (-20V THRU P1-2) USED ON FL1-2 SYSTEMS	5.5 dB MAX.	076-18566-001
004	W1 EQUIPPED USED ON DM2-2A-6 RCVR	3.6 dB MAX.	076-18566-002



SD-18566

REVISIONS

ISSUE	APPROVED	DATE
1	[illegible]	4-26 74
OPTION 002 ADDED. ECN 6099.		
2	[illegible]	3/21 78
NOTE 2 ADDED. ECN 6275.		
A	[illegible]	8/17 78
OPTION 003 ADDED. ECN 6332.		
3	[illegible]	9/14 78
-20/-21V WAS -21V. ECN 6729.		
A	WW	6/27 79
OPTION 004 ADDED. ECN 6870.		
4	BGW	8/30 79

TI NOT REQUIRED

[2] OPERATING FREQUENCY RANGE: 1700 TO 2300 MHz
GAIN: 20 dB

INPUT & OUTPUT VSWR: 2.1 MAX.
INPUT & OUTPUT IMPEDANCE: 50 OHMS
RF CONNECTORS: SMA (FEMALE)
POWER REQUIREMENT: -20/-21V DC AT 40 mA MAX.

[1] EQUIPMENT OPTIONS ARE PER TABLE A.

NOTES:

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON:

SCALE ——	ENGR. BY GS	APP'VD. [illegible]
DATE 4-17-74	DRAWN BY kc	APP'VD. RK

Farinon

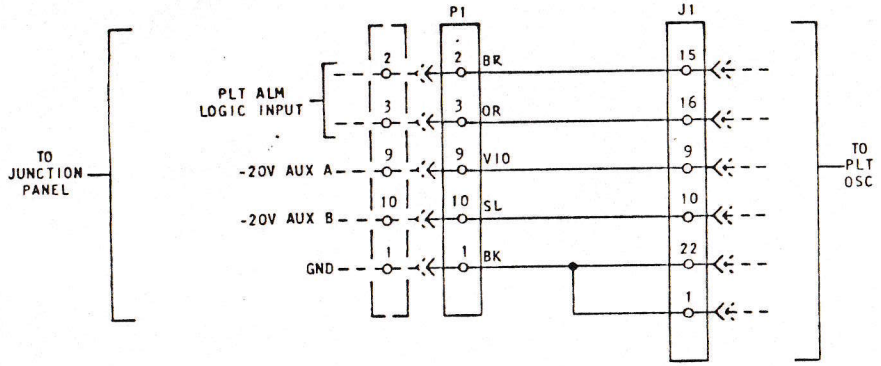
2 GHz AMPLIFIER

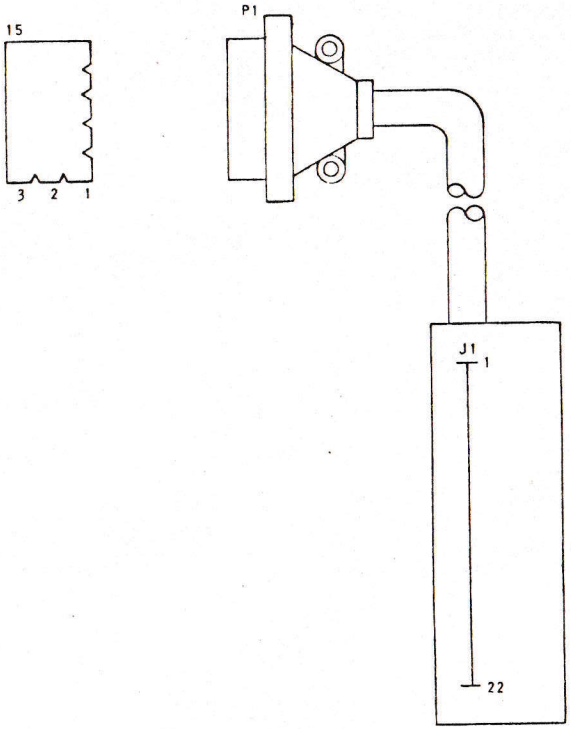
ORIG.		SHEET | OF | SHEETS	DWG. SIZE
DIST.	R		

SD-18566 B

-82871

REVISIONS			
LTR	APPROVED	DATE
1	[illegible]	10-5-76
	SL WAS SHLD IN ERROR. ECM 5222.	
A	[illegible]	6/30 77





TI NOT REQUIRED

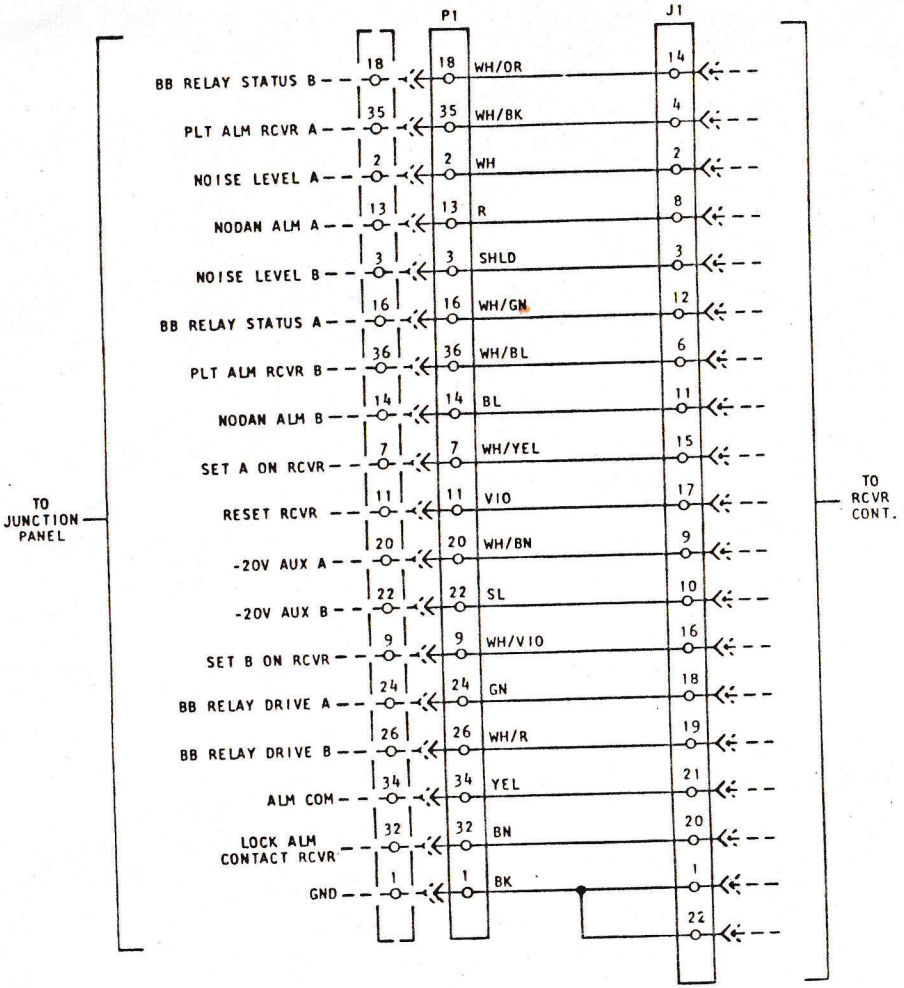
SCALE NONE	ENGR. BY GW	APP'VD.
DATE 9-9-76	DRAWN BY EJ	APP'VD.

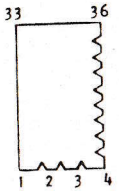
Farinon

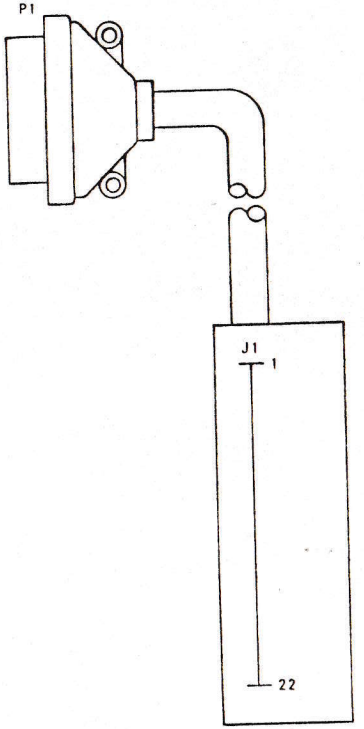
PLT OSC
PLUG-IN ASSY

ORIG.	EM	SHEET / OF / SHEETS	DWG SIZE
DIST.	R		
SD-82871			C

REVISIONS	
APPROVED	DATE
Y.V.	10-5-76







TI NOT REQUIRED

SCALE NONE	ENGR. BY GW	APP'VD.
DATE 9-8-76	DRAWN BY EJ	APP'VD.

Farinon

RCVR CONT
PLUG-IN ASSY

ORIG. DIST.	FM	SHEET / OF / SHEETS	DWG SIZE
SD-82885			C

TABLE A [5] [6]

APPLICATION	OPT.	PRE-EMPH FOR CHAN CAP.	rms DEV KHz	L3 µH	C/8 pF	OUTPUT PWR INTO 75Ω AT 100 KHz (dBm)	STRAP	C20 (µF)	R40 (Ω)	R41 (Ω)	KIT NUMBER
FL RADIO	001	120	200	53	1006	-15.5	X	—	—	—	099-000120-103
	002	300	280	22	448	-12.8	X	—	—	—	099-000300-103
	003	420	200	16	309	-15.8	X	—	—	—	099-000420-103
	004	300	200	22	448	-15.8	X	—	—	—	099-000300-103
	005	480	200	14.6	270	-15.8	X	—	—	—	099-000480-103
	006	600	140	10.7	215	-18.9	X	—	—	—	099-000600-103
	007	600	*	10.7	215	-14.4	X	—	—	—	099-000600-103
FM RADIO WITH SD-83216 SD-83217 OR SD-83226 INTERFACE	008	60	60	97.3	1870	-28.1	Y	6.8	56	620	099-000060-103
	009	60	180	97.3	1870	-18.6	X	6.8	56	620	099-000060-103
	010	120	126	53	1006	-22.6	X	—	—	—	099-000120-103
	011	120	200	53	1006	-18.6	X	—	—	—	099-000120-103
	012	240	65	28	534	-28.6	Y	—	—	—	099-000240-103
	013	300	200	22	448	-18.9	X	—	—	—	099-000300-103
	014	480	200	14.6	270	-18.9	X	—	—	—	099-000480-103
	015	600	140	10.7	215	-22	X	—	—	—	099-000600-103
	016	600	200	10.7	215	-19	X	—	—	—	099-000600-103
FM RADIO WITH SD-83227 OR SD-83256 INTERFACE	017	60	60	97.3	1870	-28.1	Y	6.8	56	620	099-000060-103
	018	60	180	97.3	1870	-18.6	X	6.8	56	620	099-000060-103
	019	120	126	53	1006	-22.6	X	—	—	—	099-000120-103
	020	120	200	53	1006	-18.6	X	—	—	—	099-000120-103
	021	240	65	28	534	-28.6	Y	—	—	—	099-000240-103
	022	300	200	22	448	-18.9	X	—	—	—	099-000300-103
	023	480	200	14.6	270	-18.9	X	—	—	—	099-000480-103
	024	600	140	10.7	215	-22	X	—	—	—	099-000600-103
	025	600	200	10.7	215	-19	X	—	—	—	099-000600-103
FL RADIO FLAT BB [8]	026	TOP BB FREQ 2660 KHz	140	-	-	-15.0	X	—	—	—	NONE
	027	TOP BB FREQ 2044 KHz	200	-	-	-12.0	X	—	—	—	NONE

* 200 WITH 480 CH LOADING

[8] FOR FLAT BB APPLICATIONS R36 AND R37 ARE OMITTED AND R38 IS 243Ω 1% (61-002433-000).

[7] LOW FREQUENCY PILOT OUTPUT USED ON FM2000 OLP SYSTEMS WHEN PILOT FREQUENCY $\leq$ 331 KHz.

[6] FOR OUTPUT POWER, SEE TABLE A.

[5] EQUIPMENT AND STRAPPING OPTIONS ARE PER TABLE A.

4. UNLESS OTHERWISE SPECIFIED, DIODES ARE 1N4454.

3. TRANSISTOR BASE CONFIGURATION: 2N4125 

2N5109
2N2219
2N2905A 

2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE STATED, ALL RESISTORS ARE 1/4W, 5%; 1% RESISTORS ARE 1/8W, CAPACITORS ARE IN MICROFARADS AND INDUCTORS ARE IN MICROHENRIES.

NOTES:

SD-83144		
REVISIONS		
ISSUE	APPROVED	DATE
E		7/[illegible]
VALUES WERE: R31-182, R25-100, R32-78.7, R35-511, R34-82.5, R1-75, R40, 41, 42, C20 & OPTS. 008 THRU 025 ADDED PC BD WAS ISS. 2 ECN 5941.		
6	JMS	3/2 78
OPTIONS 026 AND 027 ADDED. ECN 6540		
7	[illegible]	2/26 79
ADDED FB'S 4,5,6. ECN 6850.		
8	WW	8/9 79

LAST NUMBER USED

R42, C20, CR2, L3, Q12, FB6.

NUMBERS OMITTED

R12, C7

SYM	DESCRIPTION
	LEGEND
[ ]	DENOTES PRINTED BOARD MARKING.
□	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
-o-	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
-●-	REFERS TO CIRCUIT JUNCTION POINT.

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL: ——
FINISH: ——
PROCESS: ——
USED ON: FL SERIES EQPT

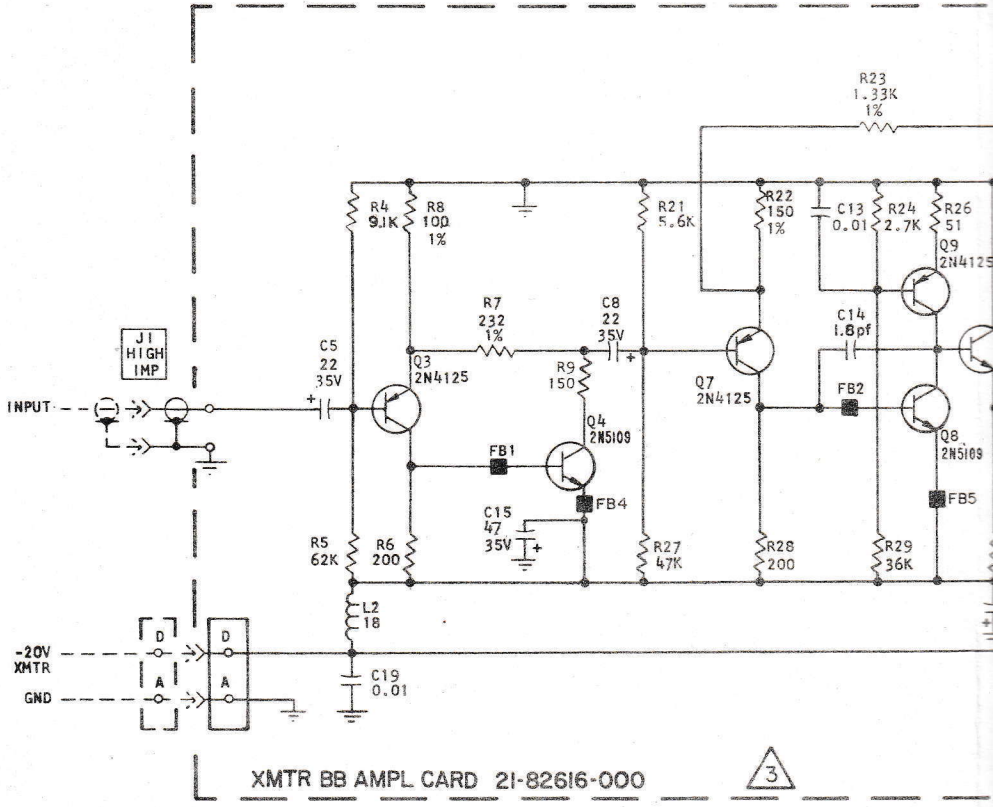
SCALE NONE	ENGR. BY WD	APP'VD.
DATE 3-9-78	DRAWN BY LK	APP'VD.

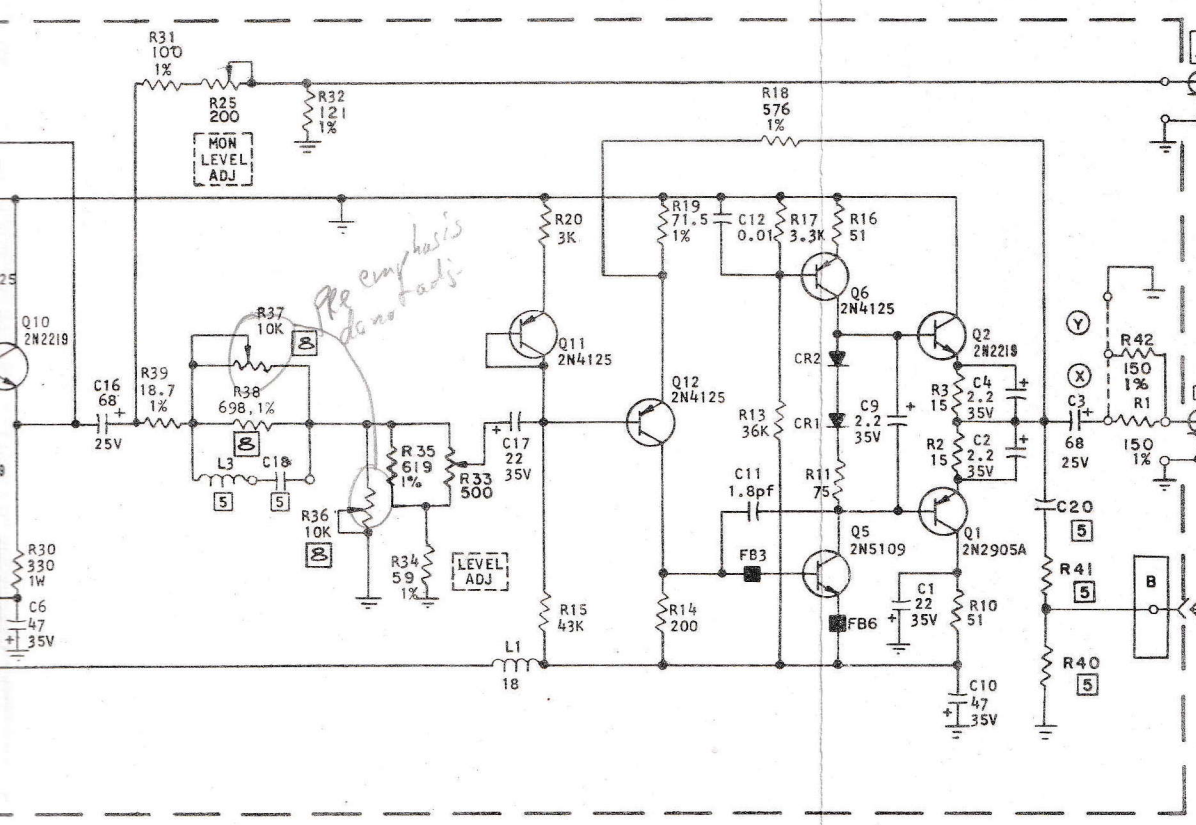
Farinon

XMTR BB AMPL

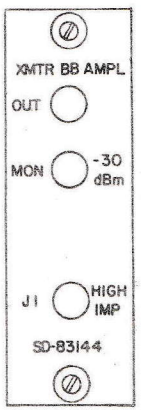
ORIG.
DIST.
SHEET 1 OF 2 SHEETS
DWG SIZE

SD-83144 D


R23
1.33K
1%
R4
9.1K
R8
100
1%
R21
5.6K
R22
150
1%
C13
0.01
R24
2.7K
R26
51
Q9
2N4125
R7
232
1%
C8
22
35V
C14
1.8pf
J1
HIGH
IMP
C5
22
35V
Q3
2N4125
R9
150
Q7
2N4125
FB2
INPUT
Q4
2N5109
Q8
2N5109
FB1
FB4
FB5
C15
47
35V
R5
62K
R6
200
R27
47K
R28
200
R29
36K
L2
18
-20V
XMTR
GND
D
A
D
A
C19
0.01
XMTR BB AMPL CARD 21-82616-000
3



SD-83144		
REVISIONS		
ISSUE	APPROVED	DATE
1		2-19-76
ADDED OPT. 004, ECN 4065		
2	YK	4-23-76
C16 & C3 WERE 35V. (TYP. ERROR).		
2A	YK	5-19-76
ADD OPT -005 ECN 4697		
3	YK	2-3-77
R35 WAS 2.7. R34 WAS 130. R33 WAS 200 & WAS IN SERIES BTWN R34 & R35. PC BD WAS ISS. 1. OPT -006 ADDED. ECN 5131.		
4	YK	5/26 77
007 OPT. ADDED. OUTPUT PWR WAS TBL B. ECN 5316.		
5		7/18 77
6	JMS	3/2 78
7	99	2-26 79
8	WW	8/10 79



ISSUE NO. CROSS REFERENCE

SD	1	2	3	4	5	6	7	8	
TI	1	1	2	3	3	4	4	4	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

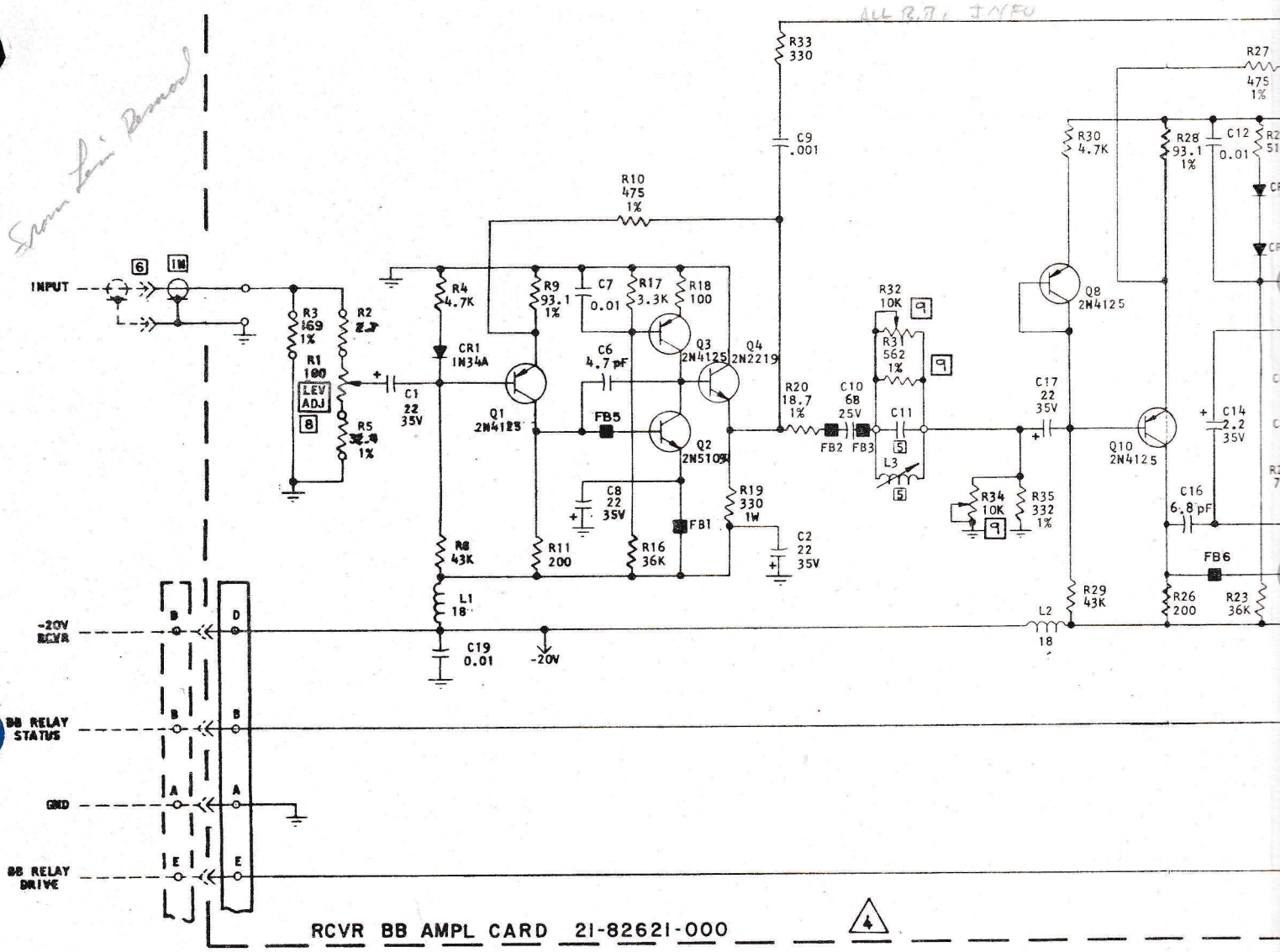
MATERIAL: —
FINISH: —
PROCESS: —
USED ON: FL SERIES EQPT

SCALE NONE	ENGR. BY WD	APPVD. RJ
DATE 6-20 75	DRAWN BY RH	APPVD.

Farinon

XMTR BB AMPL

ORIG. DIST.	SHEET 2 OF 2 SHEETS	DWG. SIZE
SD-83144		D



RCVR BB AMPL CARD 21-82621-000 4

9 OPTIONS 016, 017, 116 & 117 ARE FOR FLAT BB AMPLIFICATION. R32 AND R34 ARE OMITTED AND R31 IS 182Ω 1% (61-001823-000).

8 LEVEL ADJUST NOT AVAILABLE TO CUSTOMER ON FM RADIO APPLICATIONS.

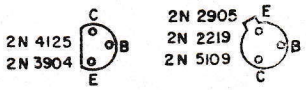
7 RELAY IS SHOWN IN ENERGIZED (NORMAL POSITION).

6 FOR INPUT LEVEL, SEE TABLE A.

5 EQUIPMENT OPTIONS & STRAPPING ARRANGEMENTS SEE TABLE A.

4. UNLESS OTHERWISE SPECIFIED ALL DIODES ARE IN4454

3. TRANSISTOR BASE CONFIGURATION.



2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

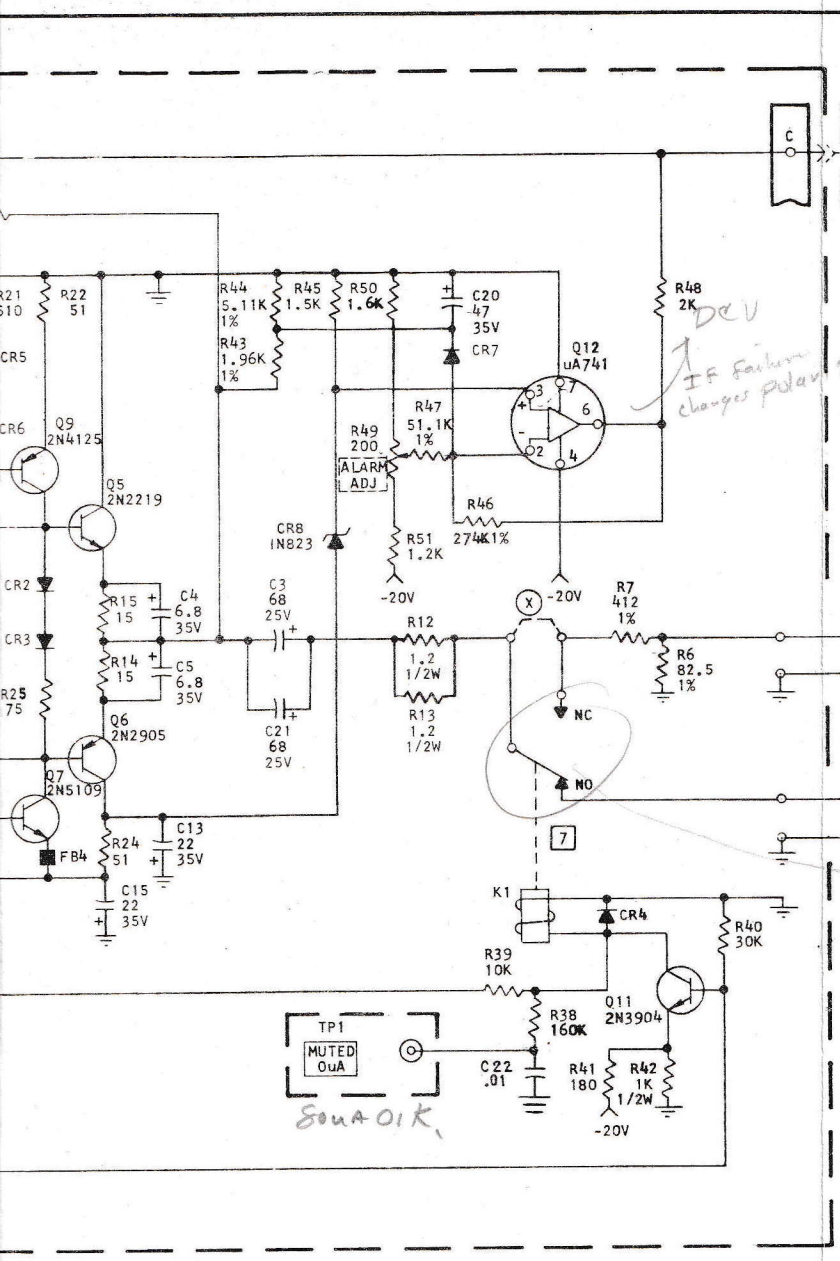
1. UNLESS OTHERWISE STATED, ALL RESISTORS ARE 1/4W, 5%, 1% RESISTORS ARE 1/8W. CAPACITORS ARE IN MICROFARADS AND INDUCTORS ARE IN MICROHENRIES.

NOTES:

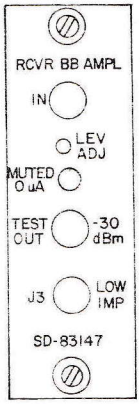
TABLE A 5 6

OPTIONS		CHAN CAP.	RMS DEV KHz	APPLICATION 6	INPUT LEVEL AT 100 KHz dBm
NON PROT WITH X STRAP	PROT NO X STRAP				
001	101	120	200	FL RADIO	-33.5
002	102	300	280	FL RADIO	-30.8
003	103	420	200	FL RADIO	-33.8
004	104	300	200	FL RADIO	-33.8
005	105	480	200	FL RADIO	-33.8
006	106	600	140	FL RADIO	-36.9
007	107	60	60	FM RADIO	-27.6
008	108	60	180	FM RADIO	-27.6
009	109	120	126	FM RADIO	-28.6
010	110	120	200	FM RADIO	-28.6
011	111	240	65	FM RADIO	-28.9
012	112	300	200	FM RADIO	-28.9
013	113	480	200	FM RADIO	-28.9
014	114	600	140	FM RADIO	-32.0
015	115	600	200	FM RADIO	-32.0
016	116	600	140	9 FL RADIO	-33.0
017	117	≤ 480	200	9 FL RADIO	-30.0

SD-83147



L3 µH	C11 pF	KIT NUMBER
98	534	099-000120-203
40.7	243	099-000300-203
29.9	169	099-000420-203
40.7	243	099-000300-203
25.0	150	099-000480-203
19.9	110	099-000600-203
181	1006	099-000060-203
181	1006	099-000060-203
98	534	099-000120-203
98	534	099-000120-203
50.9	287	099-000240-203
40.7	243	099-000300-203
25.0	150	099-000480-203
19.9	110	099-000600-203
19.9	110	099-000600-203
-	-	NONE
-	-	NONE



LAST NO. USED

R51, C22, CR8, Q12, FB4

NUMBERS OMITTED

R36, R37, C18

SYM	DESCRIPTION
	LEGEND
[ ]	DENOTES PRINTED BOARD MARKING.
□	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—•—	REFERS TO CIRCUIT JUNCTION POINT.

ISSUE NO. CROSS REFERENCE

SD	1	2	3	4	5	6	7	8	9	10	
TI	1	1	1	1	2	3	4	4	4	4	4

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64" | ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .002"

MATERIAL:
FINISH:
PROCESS:
USED ON: FL SERIES EQPT

SCALE NONE	ENGR. BY WD	APP'VD.
DATE 10-2-75	DRAWN BY RH	APP'VD.

Farinon

RCVR BB AMPL

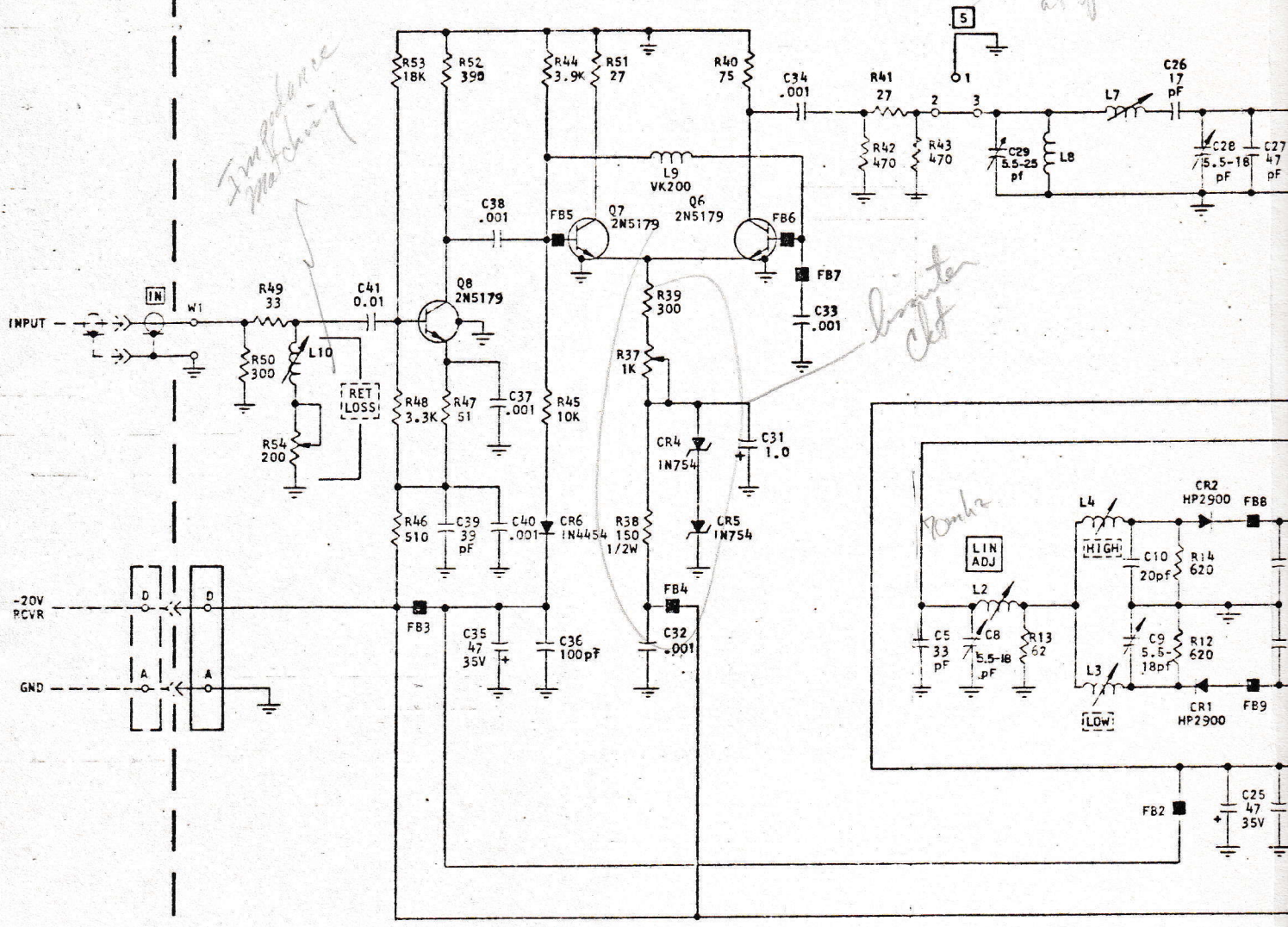
SHEET / OF / SHEETS

SD-83147 D

SD-83147

REVISIONS

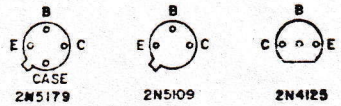
ISSUE	APPROVED	DATE
1	[illegible]	2-20-76
ADDED OPT 004. ECN 4065		
2	YK	4-23-76
C10 & C3 WERE 35V. (TYP. ERROR).		
2A	YK	5-19-76
ADDED C21 ECN-4141		
3	YK	6-21-76
ADDED OPT 005 ECN 4638		
4	YK	2-3-77
R3 WAS 118. R2 WAS 45.3. R5 WAS 56.2. OPT. 006 ADDED. ECN 5193.		
5	dms	6/8 77
R2 WAS 1%. (ERROR). ECN 5643.		
A	dms	12/6 77
OPTS. 007 THRU 015 & 107 THRU 115 & NOTE 8 ADDED. ECN 5972.		
6	dms	3/2 78
PC BD WAS ISS. 2. (MECH CHG). ECN 6202.		
7	HP	6/13 78
C6 WAS 3.3 pF. C16 WAS 4.7 pF. FB1 & FB4 WERE AT BASE OF Q2 & Q7. ECN 6521.		
8	[illegible]	1/23 79
OPTS. 016, 017, 116 & 117 ADDED. ECN 6540. C22 ADDED. PC BD WAS ISS. 3. ECN 6521A.		
9	[illegible]	2/26 79
FB5 & FB6 ADDED. ECN 6521A.		
10	WW	4/19 79



LIM DEMOD CARD 21-82683-001 4

6. THIS UNIT IS OPTION -001.

5 NORMAL OPERATION IS WITH U-LINKS 2-3, 4-5, 6-7.



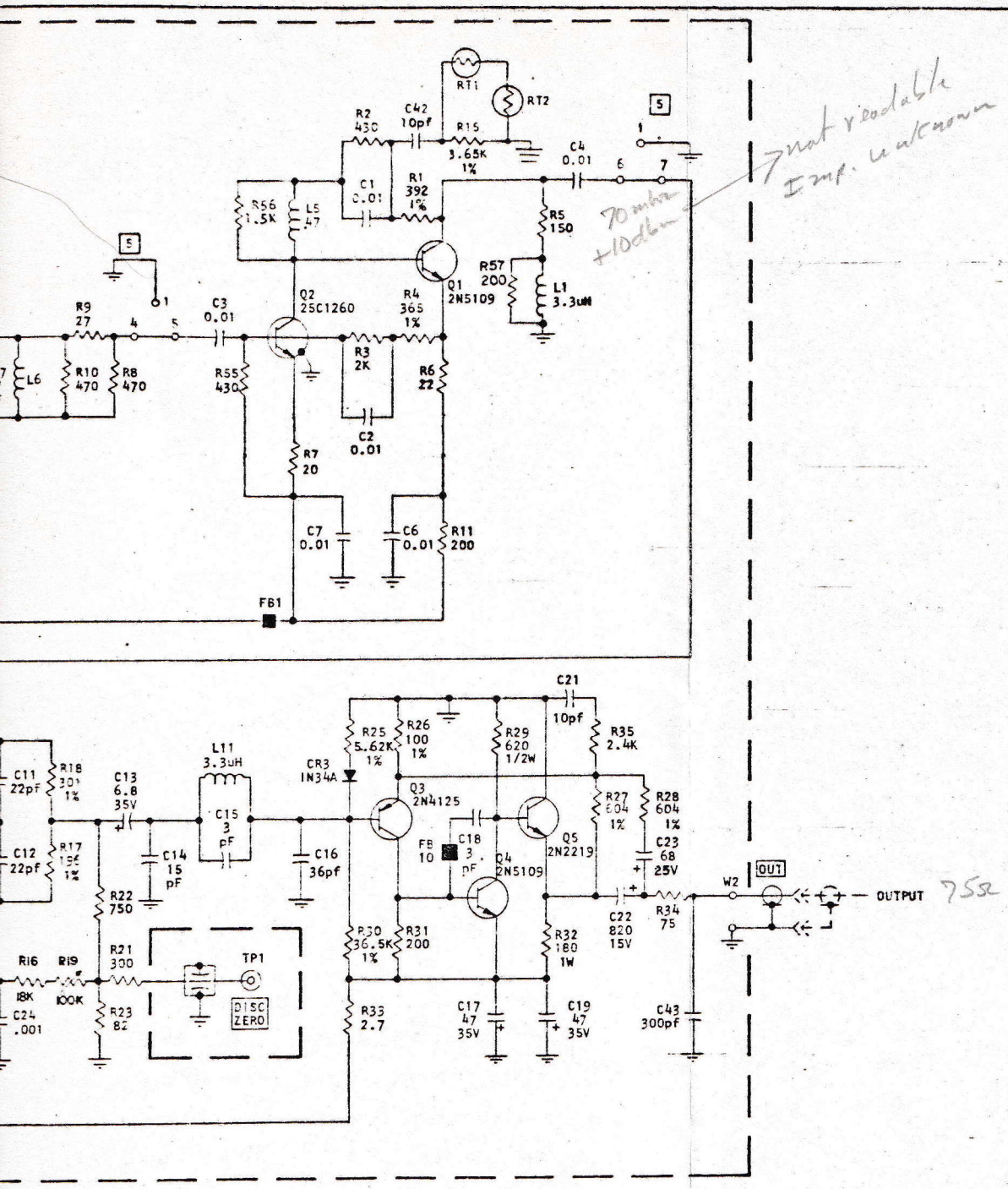
4. TRANSISTOR BASE CONFIGURATION.

3 NOT ASSIGNED.

COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ±5%, 1/4W, 1% RESISTORS ARE 1/8W, AND CAPACITOR VALUES ARE IN MICROFARADS.

NOTES:



SD-83149-M2 REVISIONS		
ISSUE	APPROVED	DATE
1		
R16 & R19 REPLACED R24 (NOM 6[illegible]). C23 WAS 35V. PC BD WAS ISS. 1. ECN 6[illegible].		
2		7/25 77
R56 ADDED. C31 WAS .01. C29 WAS 10-40 pF. C27 WAS 22 pF. PC BD WAS ISS. 2. ECN 6188.		
3		6/13 78
R57 ADDED. ECN 6506.		
4		1/15 79
PC BD WAS ISS. 3. ECN 6506A.		
A		4/16 79

LIM DEMOD
DISC ZERO
IN
LIN ADJ
OUT
SD-83149-M2

LAST NO. USED

R57, L11, Q8, CR6, C43
TP1, FB10, RT2

NUMBERS OMITTED

C30

SYM	DESCRIPTION
	DENOTES PRINTED BOARD MARKING.
	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
	REFERS TO CIRCUIT JUNCTION POINT.

LEGEND

ISSUE NUMBER CROSS REFERENCE

SD	1	2	3	4						
TI	1	1	1	1						

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE: 2 PLACE DECIMALS ± .01 | ANGULAR DIMENSIONS ± 1° 3 PLACE DECIMALS ± .005 | FRACTIONAL DIMENSIONS ± 1/64 | HOLES UNDER .250 DIA ± .002

MATERIAL
FINISH
PROCESS
USED ON FL SERIES EQPT.

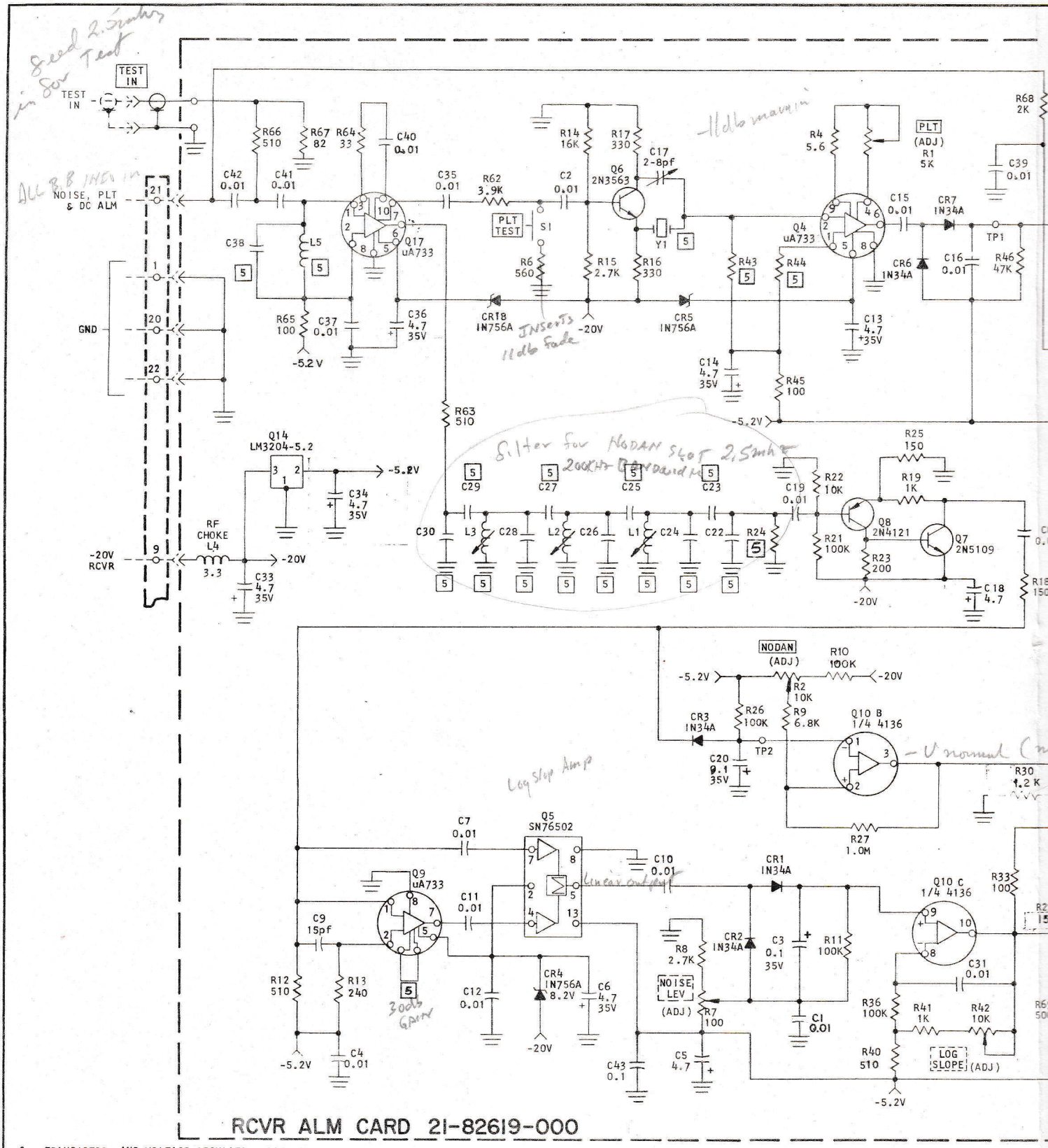
SCALE NONE DRAWN BY BGW APP'D
DATE 3 3 77 DRAWN BY RH APP'D

Farinon

LIM DEMOD

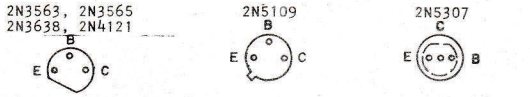
SHEET 1 OF 1 SHEETS

SD-83149-M2 D



RCVR ALM CARD 21-82619-000

3. TRANSISTOR AND VOLTAGE REGULATOR BASE CONFIGURATIONS.



2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ± 5%, 1/4W, 1% RESISTORS ARE 1/8W, AND CAPACITOR VALUES ARE IN MICROFARADS.

NOTES:

[9] CR19, 22, 23, 24, R70, R72 NOT EQUIPPED ON THIS UNIT.

[8] SEE TABLE D.

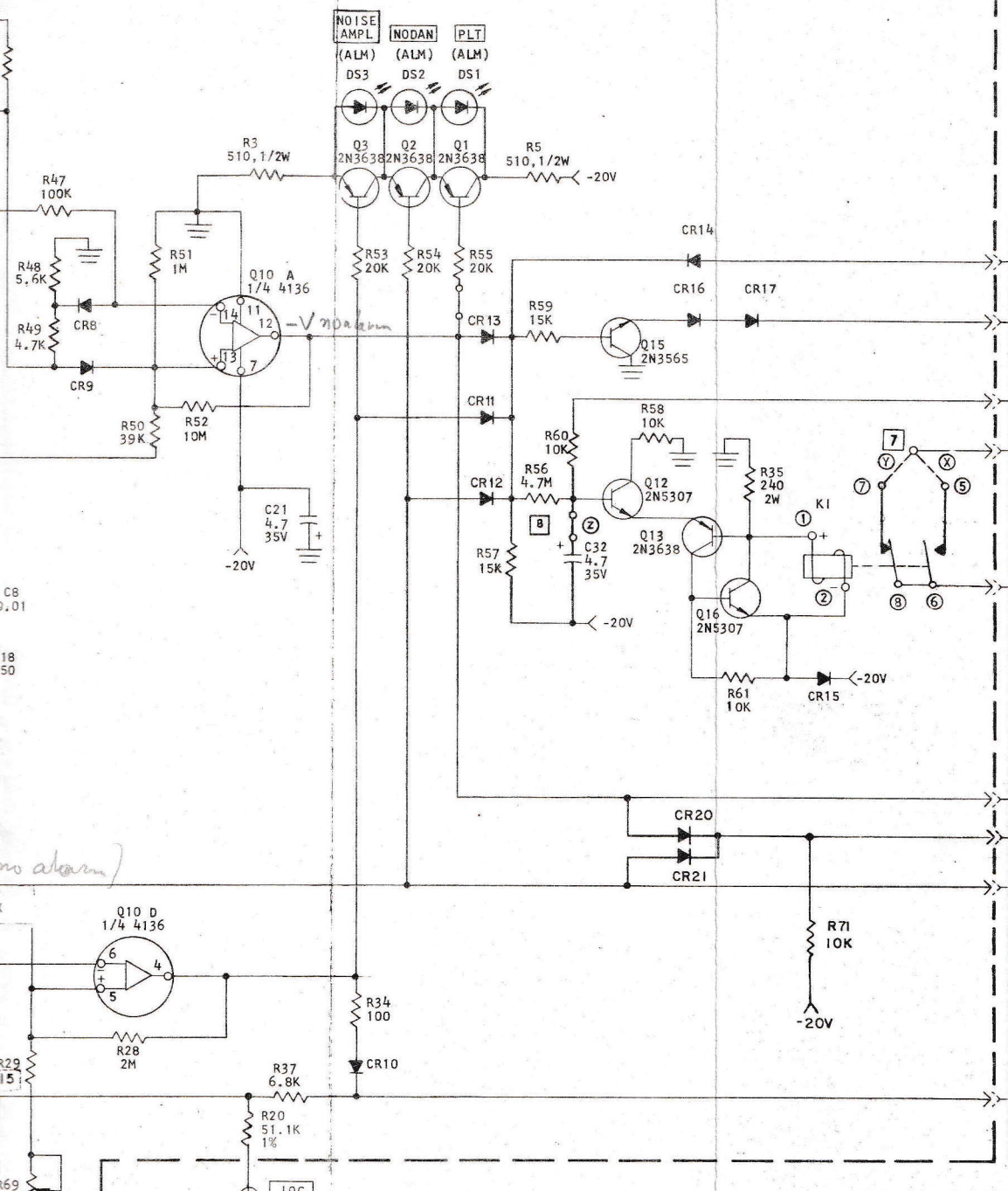
[7] FOR ALARM CONTACTS NORMALLY OPEN: STRAP X (FURNISHED).
FOR ALARM CONTACT NORMALLY CLOSED: STRAP Y.

[6] RELAY SHOWN ENERGIZED (NORMAL POSITION).

[5] SEE TABLE A FOR UNIT OPTIONS.
SEE TABLES B & C FOR COMPONENT VALUES.

4. UNLESS OTHERWISE SPECIFIED ALL DIODES ARE 1N4454.

SD-83150



OPT. 001: R24 WAS 1K, Q9 STRAP WAS 4-9. PC BD WAS ISS. 5. ECN 6996.

12 WHJ 11/30/79

R25 WAS 200, R22 WAS 13K. ECN 7204.

13 Bohm 5/28/80

SD-83150

REVISIONS

ISSUE	APPROVED	DATE
1	DP	2-20-76

CR6 & 7 WERE IN4454, R47 WAS 10K, R48 WAS 7.5K, R50 WAS 1.5K, R51 WAS 200K, R52 WAS 2M, R26 WAS 4.7K, R9 WAS 1K, C20 WAS 1uF ECN 4073.

2 YK 5-10-76

R8 WAS 4.7K. R50 WAS 68K. TITLE WAS "RCVR ALM (PROTECTED)." TABLES A&B:- PLT FREQ KIT Nº WAS 099-01975-203. TABLES A&C:- NOISE SLOT FREQ KIT Nº WAS 099-02500-003. ECN 4079A.

3 RC 5-27-76

ISSUE "2" ON BOARD WAS "1."

3A YK 10-26-76

R63 WAS 150; R10 WAS 470K. CR13 WAS 11, CR11 WAS 12, CR CR12 WAS 13. DELETED FROM: TABLE A, OPT-008; TABLE B PILOT KIT 099-08800-504; TABLE C, NOISE KIT 099-09500-504. ADDED TO: TABLE A&B, KIT NO 099-03200-504; TABLE A&C, KIT NO 099-04300-404, TABLE C, KIT 099-02500-404; C28 WAS 1500pF, C23 WAS 240pF, C24 WAS 200pF, C25 WAS 12pF, C27 WAS 12pF, C28 WAS 200pF, C29 WAS 240pF, C30 WAS 1100pF. ECN-4700, 4700A

4 YK 2-10-77

R1 WAS 1K, C3 WAS .01uF ECN-4980.

5 YK 4-5-77

ADDED NOTE 8 & TABLE D. ECN-5113

5A YK 5-9-77

STRAP OPT 2 ADDED. (C32 WAS RQD FOR 3m SEC DELAY) ECN 5188

6 jms 5-27-77

R26 WAS 47KΩ, R27 WAS 2M. ECN 5549.

7 HP 9/15/77

CR23 ADDED. PC BD WAS ISS. 4. ECN 5755.

8 jms 12/6/77

CR20, CR21, R71 & OPTS. 001, 002, 011 ADDED. R62 WAS 11K. OPT. 004 PLT KIT WAS -504. (C38 & L5 WERE 430 & 5.6.) ECN 5937.

9 jms 2/9/78

CR23 DELETED, (ADDED IN ERROR AT ISS. 8. ECN 6072.

A jms 3/13/78

R30 WAS 1.2K R29 WAS 51. ECN 6269.

10 jms 7/15/78

R39 WAS 7.5K. ECN 6485.

11 RCB for 12/20/78

LAST NO. USED

R72, C44, CR24, Q17, L5 DS3, K1, Y1, TP2

ISSUE NUMBER CROSS REFERENCE

SD	1	2	3	4	5	6	7	8	9	10	11	12	13
TI	1	1	1	1	1	2	2	3	3	3	3	3	3

NUMBERS NOT USED 9

RCVR ALM
PLT
PLT TEST
NODAN
NOISE AMPL
LOG AMPL
TEST IN
SD-83150

SYM	DESCRIPTION
	DENOTES PRINTED BOARD MARKING.
	DENOTES NOTES OR FACEPLATE MARKINGS.
	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
	REFERS TO CIRCUIT JUNCTION POINT.
	LEGEND

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE: 5 PLACE DECIMALS ± .010" 3 PLACE DECIMALS ± .005" FRACTIONAL DIMENSIONS ± 1/64" ANGULAR DIMENSIONS ± 1° HOLES UNDER .250 DIA. ± .002"

MATERIAL: ——
FINISH: ——
PROCESS: ——
USED ON: FL SERIES EQPT.

SCALE NONE | ENGR. BY JL | APP'VD. | DATE 12-12-75 | DRAWN BY K.B | APP'VD.

Farinon

RCVR ALM (LOG NOISE VOLT)

ORIG. DIST. | SHEET 1 OF 2 SHEETS | DWG. SIZE

SD-83150 D

TABLE A [5]

OPT	PILOT SEE TABLE B		NOISE SLOT SEE TABLE C	
	FREQ KHz	KIT NUMBER	FREQ MHz	KIT NUMBER
-001	607	99-00607-504	1.1	99-01100-404
-002	1499	99-01499-504	2.5	99-02500-404
-003	1975	99-01975-504	2.5	99-02500-404
-004	3200	99-03200-503	4.3	99-04300-404
-005	4715			
-006	6190			
-007	6800			
-008	8500			
-009	9023			
-010	11880			
-011	331	99-00331-504	1.1	99-01100-404

PILOT FREQ KIT NUMBER
099-01975-50
099-00331-50
099-03200-50
099-00607-50
099-01499-50

NOISE SLOT F KIT NUMBE
099-02500-4
099-04300-4
099-01100-4

TABLE D [8]

ALARM DELAY OPTION

USAGE	ALM DELAY	"STRAP" (Z)
STANDARD (FURNISHED)	≈20 SEC	(Z) INSTALLED
LOOP SWITCH SYSTEMS & OTHER SPECIAL APPLICATIONS	≈ 3 mSEC	(Z) REMOVED

TABLE B [5]

EQ ER	FREQ KHz	C38 pf	L5 uH	Y1 KHz	R43,44 OHMS
504	1975	5100	.82	1975	1K
504	331	1006	68	331	10K
503	3200	723	1.8	3200	1K
504	607	1540	18	607	5.6K
504	1499	534	8.2	1499	1K

TABLE C [5]

FREQ BER	FREQ MHz	C22 pf	C23 pf	C24 pf	C25 pf	C26 pf	C27 pf	C28 pf	C29 pf	C30 pf	L1 uH	L2 uH	L3 uH	R24	Q9 JUMPER
-404	2.5	——	51	360	24	360	24	360	51	——	9.6	9.6	9.6	1K	4-9
-404	4.3	——	15	120	6	130	6	120	20	——	9.6	9.6	9.6	1K	4-9
-404	1.1	——	10K	1300	168	1100	232	1300	10K	——	14.2	14.2	14.2	510	3-10

SD-83150

REVISIONS

ISSUE	APPROVED	DATE
1		2-20-76
SEE SHEET 1		
2		5-10-76
SEE SHT. 1		
3	RS	5-27-76
SEE SHT. 1		
3A		10-26-76
SEE SHEET 1.		
4		2-10-77
SEE SHEET 1.		
5		4-5-77
SEE SHEET 1.		
5A		5-9-77
SEE SHEET 1.		
6		5-27-77
7	HP	9/15/77
SEE SHEET 1.		
8		12/6/77
9		2/9/78
A		3/13/78
10		7-17-78
11	REQ for JL	12/28/78
12		11/30/79

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .010" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL: ——
FINISH: ——
PROCESS: ——
USED ON: FL SERIES EQPT

SCALE ——	ENGR. BY J.L.	APP'VD.
DATE 12-12-75	DRAWN BY C.R.	APP'VD.

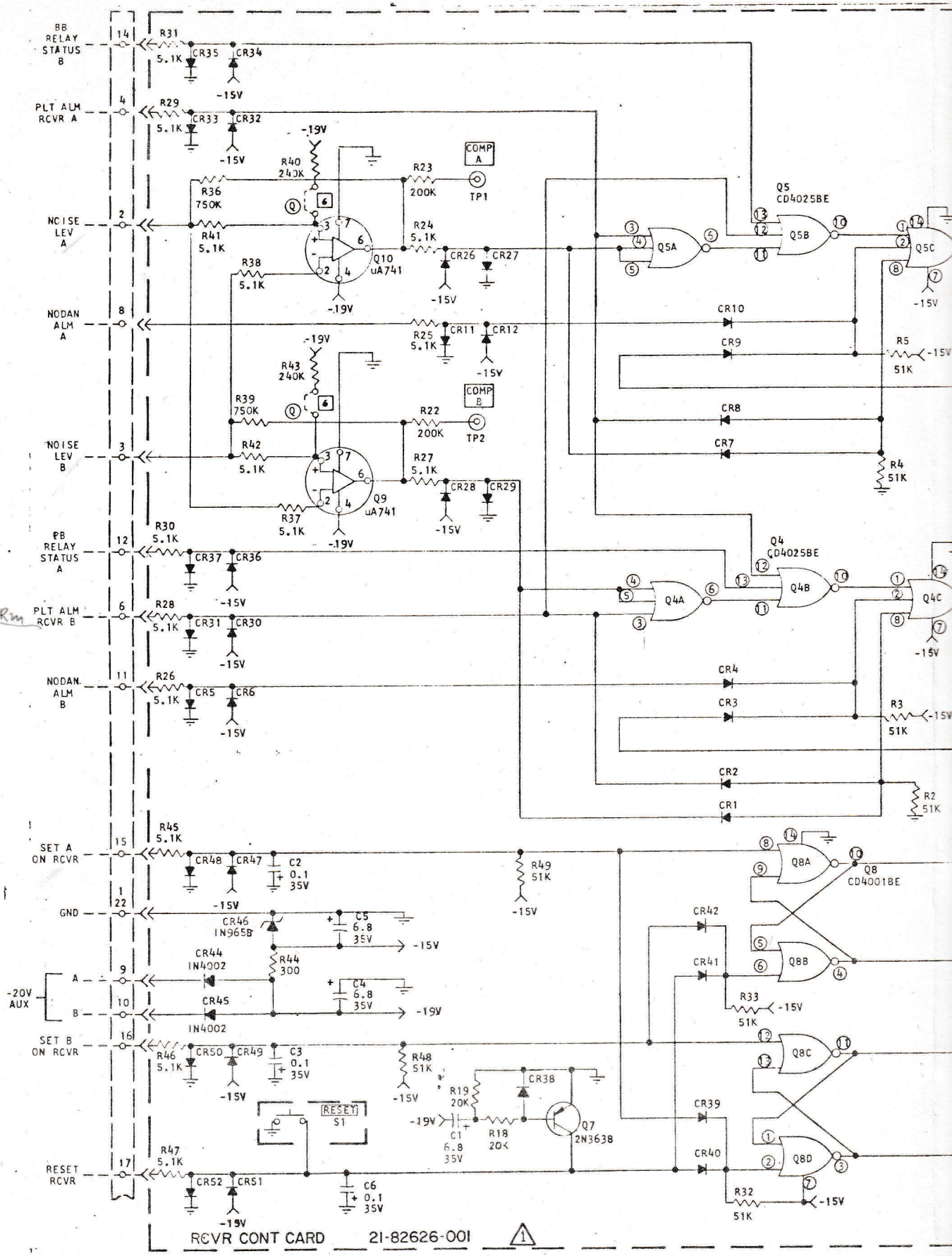
Farinon

RCVR ALM
(LOG NOISE VOLT)

SHEET 2 OF 2 SHEETS

SD-83150

DWG. SIZE D



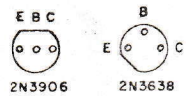
RCVR CONT CARD 21-82626-001 ⚠1

COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT TIME OF MANUFACTURE.

NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, ±5%. CAPACITORS ARE IN MICRO FARADS.

4. TRANSISTOR BASE CONFIGURATIONS:

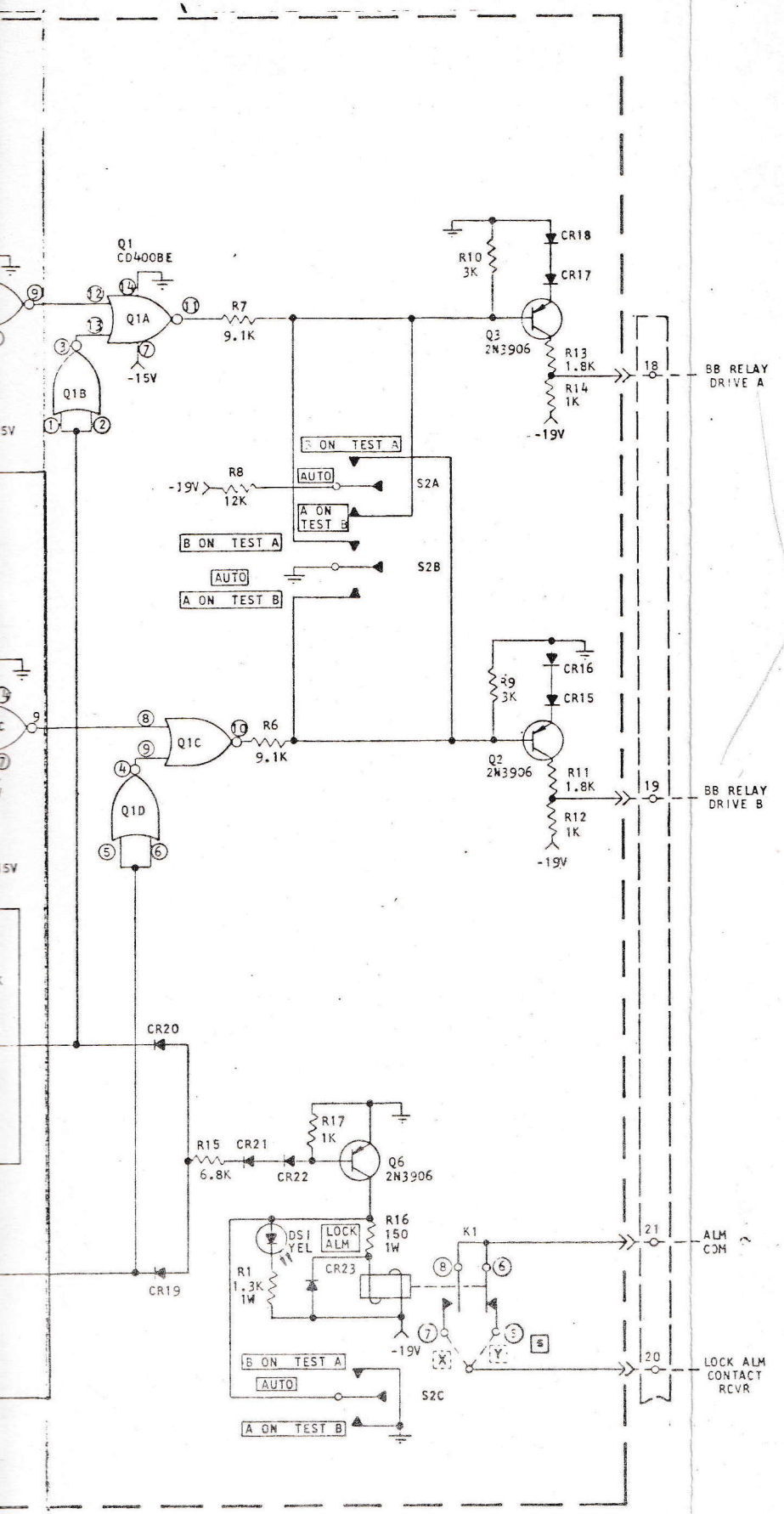


3. UNLESS OTHERWISE SPECIFIED DIODES ARE 1N4454.

5. FOR ALARM CONTACTS NORMALLY OPEN: STRAP X (FURNISHED). FOR ALARM CONTACTS NORMALLY CLOSED: STRAP Y.

8. TH
7. RE
6. FO RC SE ST

SD-83160



RCVR CONT

COMP A

COMP B

LOCK ALM

RESET

AUTO

A ON TEST B | B ON TEST A

SD-83160

-6.83V normally

SD-83160			
REVISIONS			
ISSUE	APPROVED		DATE
1	[illegible]		[illegible] 76
DELETED "PART OF 190-[illegible]."			
1A	[illegible]		10-1 76
NOTE 6 WAS 'FOR COMBINING USE STRAP Q (2 PLACES). FOR OPTIMAL SELECTION LEAVE STRAP Q OUT. (2 PLACES)'			
1B	[illegible]		2-18 77
Q1 & Q3 WERE CD4001AE. Q4 & Q5 WERE CD4025AE. CHANGED RELAY. NOTE 7 WAS 'RELAY SHOWN ENERGIZED LOCK CONDITION.'			
1C	[illegible]		4-15 77
X & Y REF. WAS REVERSED. (ERROR). ECN 5777.			
1D	HP		12/29 77

ISSUE NO. CROSS REFERENCE.

SD	1									
TI	1									

SYM	DESCRIPTION
	DENOTES PRINTED BOARD MARKING.
	DENOTES NOTES OR FACE-PLATE MARKINGS.
	DENOTES PRINTED CIR-CUIT BOARD ISSUE NUM NUMBER.
	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
	REFERS TO CIRCUIT JUNCTION POINT.

LEGEND

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .010" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64" | ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .003"

MATERIAL:

FINISH:

PROCESS:

USED ON: FL SERIES EQPT.

SCALE [illegible]	ENGR. BY [illegible]	APP'VD. RJ	
DATE [illegible]	DRAWN BY [illegible]	APP'VD.	

Farinon

RCVR CONT

ORIG.	SHEET / OF / SHEETS	DWG SIZE
DIST.		
SD-83160		D

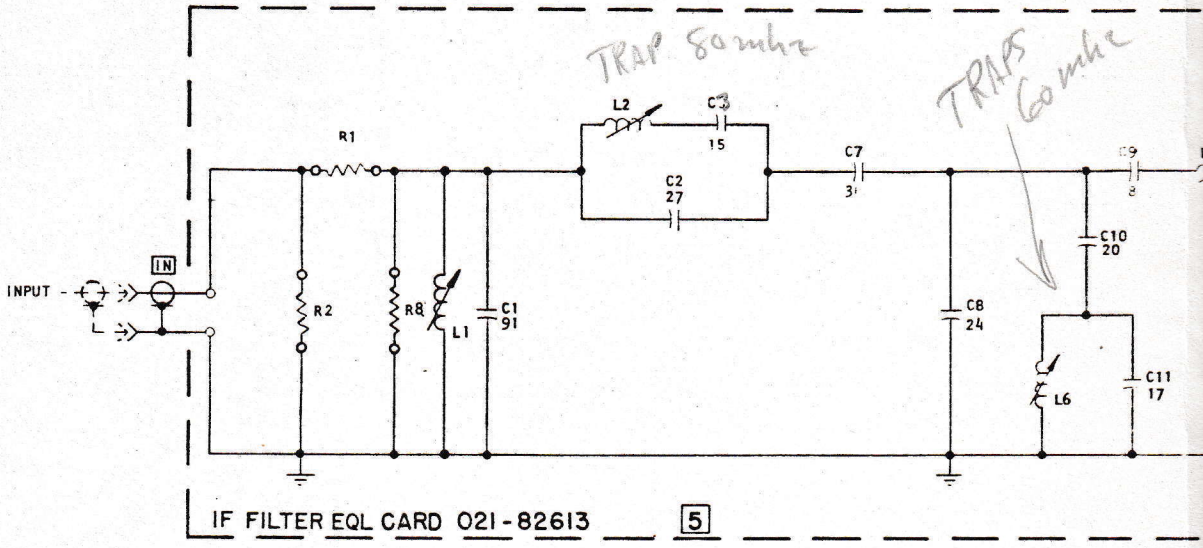
THIS UNIT IS OPTION -001.
RELAY SHOWN DE-ENERGIZED (NORMAL CONDITION).
FOR COMBINING USE (SEPARATE RCVR ANTENNAS OR 3 dB RCVR HYBRID) STRAP Q IN TWO PLACES. FOR OPTIMAL SELECTION, USE (13 dB NOMINAL RCVR COUPLER) LEAVE STRAP Q OUT IN TWO PLACES.

LAST NO. USED

R49, C6, CR52, S2

NUMBERS OMITTED:

R20, R21, R34, R35, CR13, CR14, CR24, CR25, CR43.



IF FILTER EQL CARD 021-82613 [5]

INSERTION LOSS 18db ± 1db

[5] EQUIPMENT OPTIONS ARE PER TABLE A.

[4] C4 AND C5 ARE A SPECIAL PAIR OF CAPACITORS MATCHED TO WITHIN 0.1 pf. DO NOT INSTALL UNLESS MATCHED.

[3] TERMINAL PROVIDED FOR INTERNAL TEST PURPOSES ONLY.

2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE STATED ALL RESISTORS ARE IN OHMS 1/4W ± 5%, CAPACITORS ARE IN PICO FARADS AND INDUCTORS ARE IN MICROHENRYS.

NOTES:

SD-83167			
REVISIONS			
ISSUE	APPROVED		DATE
1	[illegible]		[illegible]
ADDED NOTE 4			
1A	[illegible]		[illegible]
480 & 600 ADDED TO TABLE A. ECN 5778.			
B	[illegible]		12/28/77
OPT. 002 ADDED. ECN 6271.			
2	99		8/17/78
MPL CHG ONLY. ECN 6951.			
3	WHB		11/16/79

Equalizer EKT

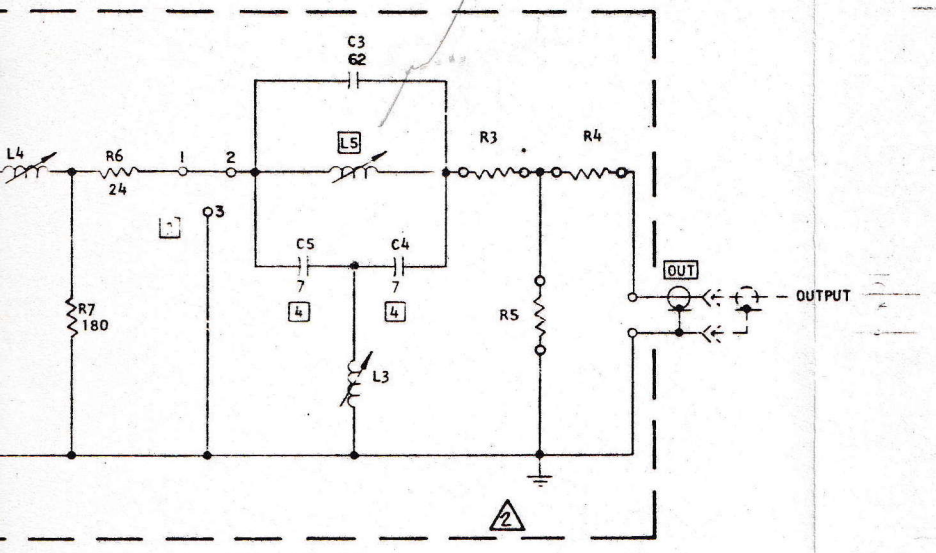
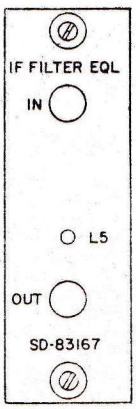


TABLE A [5]

OPT.	SYSTEM	CHAN CAP	POLES	R1	R2	R3	R4	R5	R8	FILTER/EQL CARD
001	FL1-6/7	300/420/480 (600 W/REDUCED DEV.)	70 ±10 MHz	39	180	5.6	5.6	620	NOT EQPD	021-82613-001
002	FL1-2	300/480 (600 W/REDUCED DEV.)	70 ±10 MHz	91	150	16	16	160	270	021-82613-002



SYM	DESCRIPTION
	LEGEND
[ ]	DENOTES PRINTED BOARD MARKING.
□	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—●—	REFERS TO CIRCUIT JUNCTION POINT.

LAST NO's USED

R8, L6, C11

ISSUE NO. CROSS REFERENCE

SD	1	2	2								
TI	1	2	2								

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .010" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64"
ANGULAR DIMENSIONS ± 1°
HOLES UNDER .250 DIA ± .003"

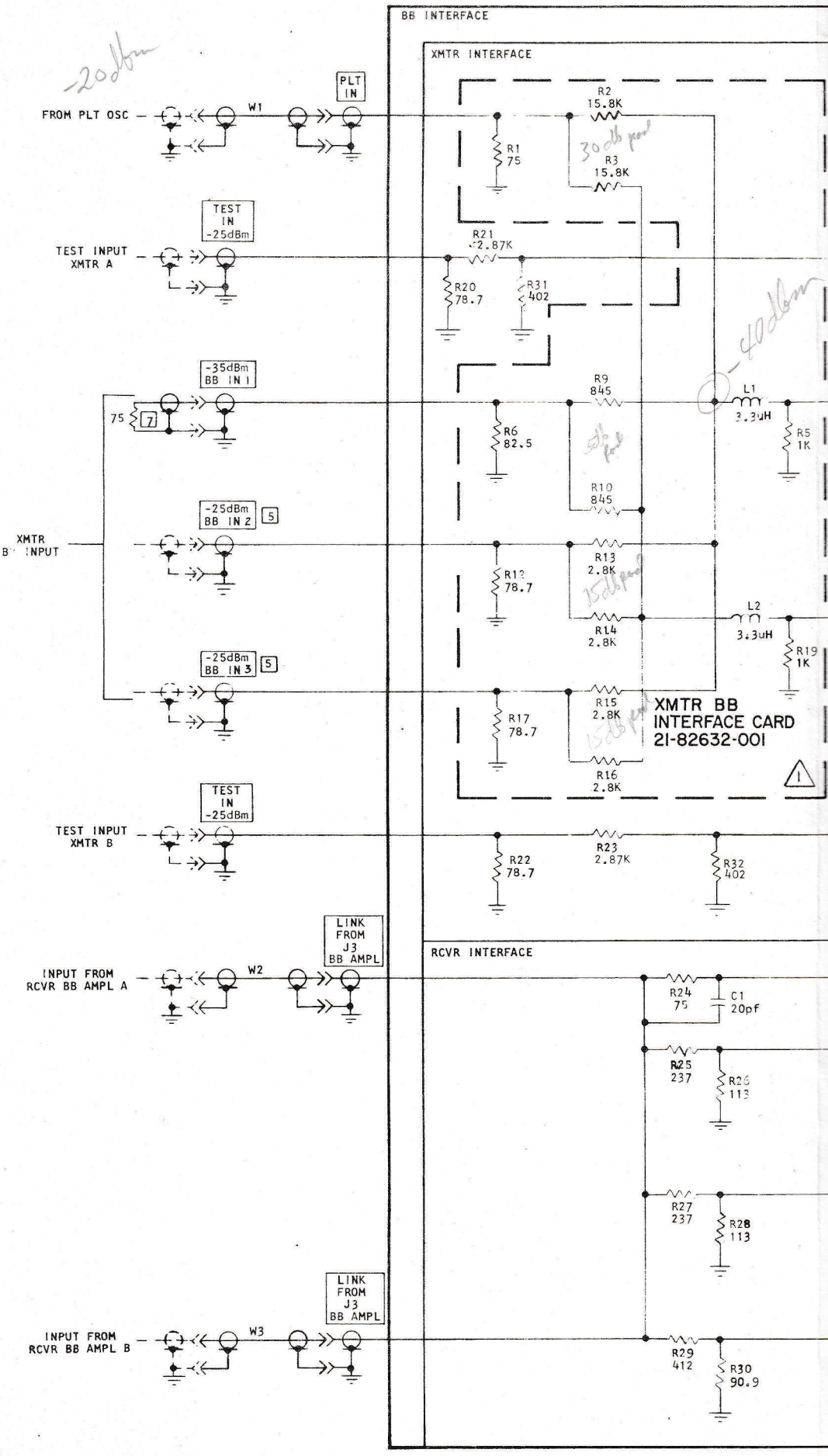
MATERIAL: ~
FINISH: ~
PROCESS: ~
USED ON: FL1-FH SERIES EQLT

SCALE NONE	ENGR. BY RS	APP'VD.
DATE 6-24-75	DRAWN BY RW	APP'VD.

Farinon

IF FILTER EQL

SHEET / OF / SHEETS	DWG SIZE
SD-83167	D



7. 75 OHM TERMINATION MUST BE PROVIDED FOR -35dBm INPUT IF NOT USED AS AN INPUT.

6. ISOLATION BETWEEN TWO -25dBm BB OUTPUTS IS 52dB TO 2.5MHz; 47dB TO 5MHz.

5. ISOLATION BETWEEN TWO -25dBm BB INPUTS IS 48dB UP TO 5MHz.

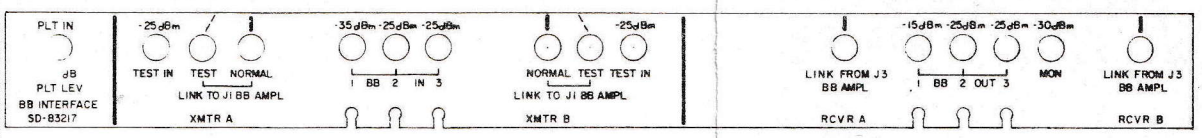
4. ALL RCVR OUTPUT IMPEDANCES ARE 75 OHMS UNBALANCED.

3. ALL XMTR INPUT IMPEDANCES ARE 75 OHMS UNBALANCED.

2. COMPONENT TYPE NUMBERS AND VALUES THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS, 1% 1/8W.

NOTES:



SD-83217		
REVISIONS		
ISSUE	APPROVED	DATE
1	[illegible]	2-17-76
DELETED R7 & R8. R31 & R32 WERE 412Ω, 1/8W, 1%. R9 & R10 WERE 1K, 1/8W, 1%. ECN-4519.		
2	[illegible]	10-12-76
NOTE 6: 52dB WAS -52db, 47dB WAS -47dB NOTE 5: 48dB WAS -48dB, DELETED NOTE 8		
2A	[illegible]	1-31-77

TEST LINK TO J1 BB AMPL

TEST OUTPUT

Test link

-40db

8

W4

TO XMTR BB AMPL A (HIGH IMP)

NORMAL LINK TO J1 BB AMPL

NORMAL OUTPUT

NORMAL LINK TO J1 BB AMPL

NORMAL OUTPUT

W5

-40db

8

TO XMTR BB AMPL B (HIGH IMP)

TEST LINK TO J1 BB AMPL

Test link

TEST OUTPUT

-15dBm BB OUT 1

6 -25dBm BB OUT 2

RCVR BB OUTPUT

6 -25dBm BB OUT 3

-30dBm MON

MON OUTPUT

LAST NO USED

L2, R32, W5, C1

NUMBERS OMITTED

R4, R7, R8, R18

TI NOT REQUIRED

SYM	DESCRIPTION
	LEGEND
⬚	DENOTES PRINTED BOARD MARKING.
□	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—●—	REFERS TO CIRCUIT JUNCTION POINT.

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64"
ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .003"

MATERIAL:
FINISH:
PROCESS:
USED ON: FL SERIES EQPT

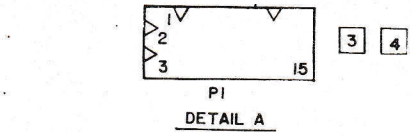
SCALE NONE | ENGR. BY WD | APP'VD. RJ
DATE 5-22-75 | DRAWN BY RH | APP'VD.

Farinon

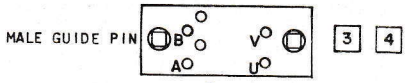
BB INTERFACE (PROT)

ORIG. RM | SHEET 1 OF 1 SHEETS | SIZE D
DIST.

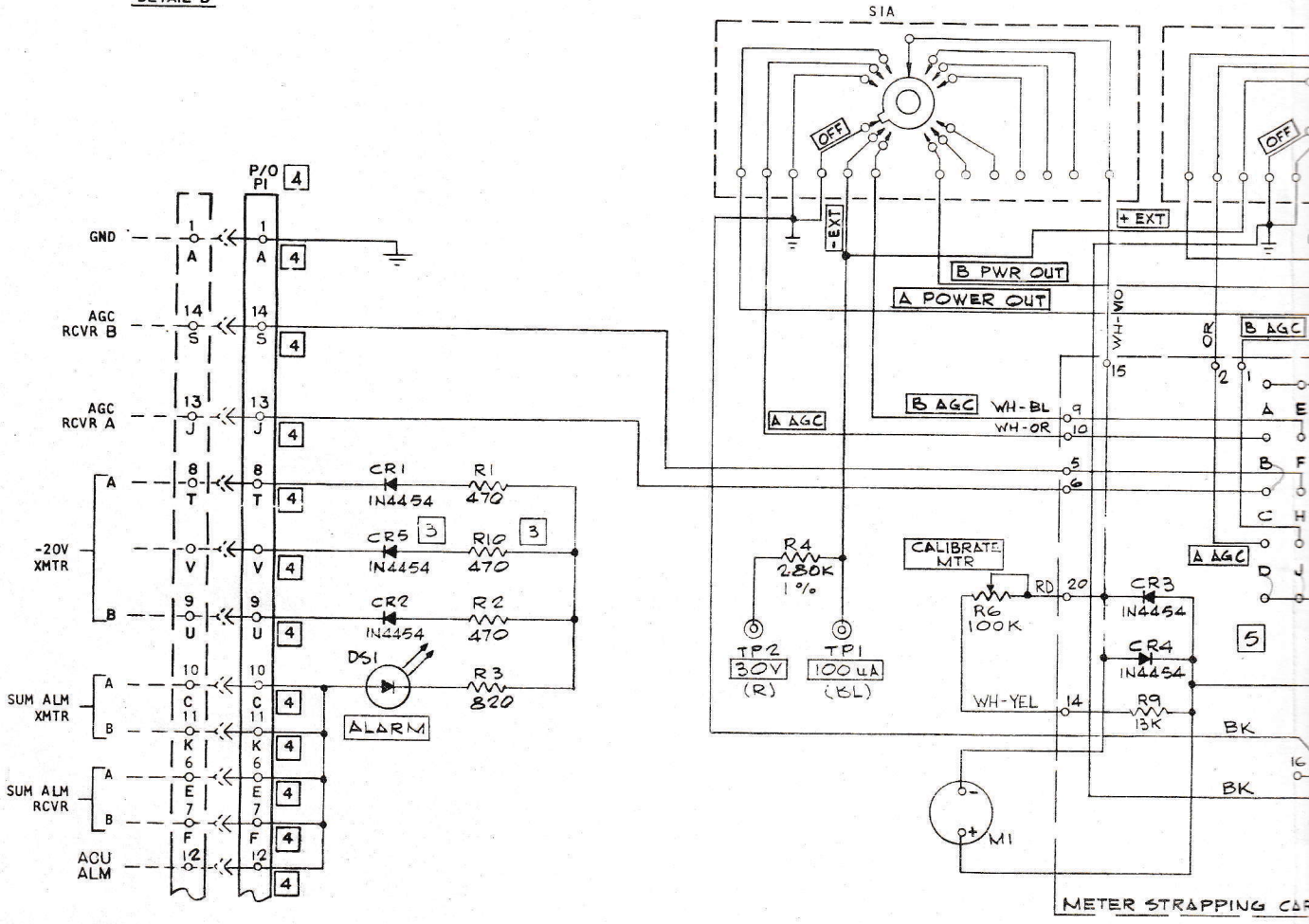
SD-83217

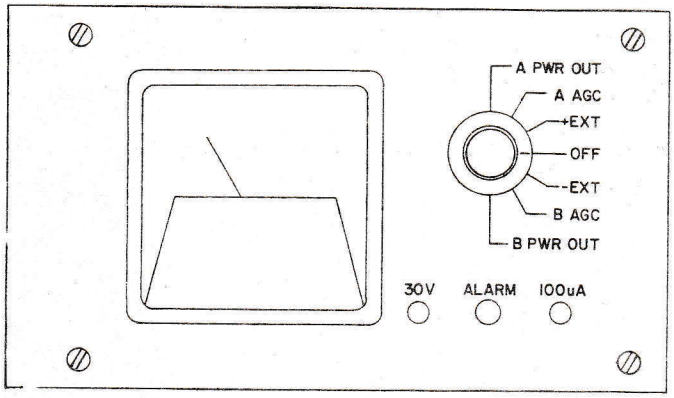


DETAIL A



DETAIL B





5 STRAPPING OPTIONS PER TABLE C.

4 P1 IS NUMBERED 1-15 (SEE DETAIL A) FOR OPTION 001. P1 IS LETTERED A-V (SEE DETAIL B) FOR OPTION 002. SEE TABLE B FOR COLOR OF WIRES CONNECTED TO P1.

3 EQUIPMENT OPTIONS ARE PER TABLE A.

2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.

NOTES:

SD-83218-M2		
REVISIONS		
ISSUE	APPROVED	DATE
1	99	11/3/78
STRAPPING CARD PC BD WAS ISS. 1. (MECH CHG.). ECN 6685.		
2	W.W	6/5 79

TABLE C [5]				
APPLICATION	A AGC	B AGC	A PWR OUT	B PWR OUT
DM, FL1-6	C A	H E	M K	S P
FL1-2	B D	F J	L N	R T

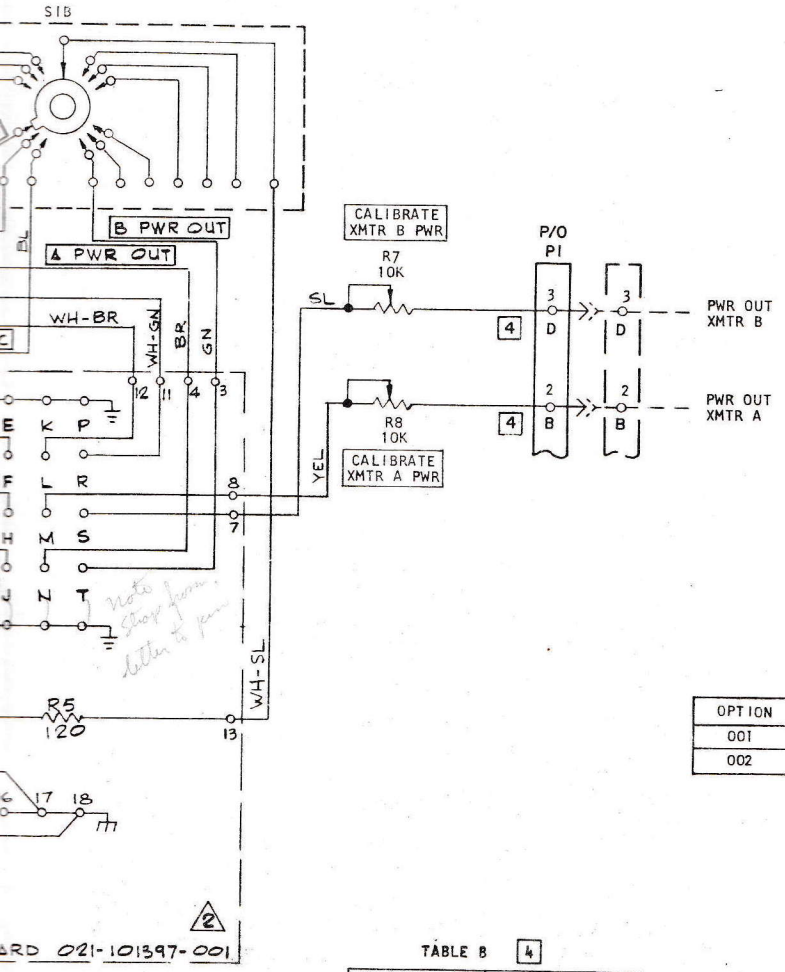


TABLE A [3] [4]				
OPTION	APPLICATION	CR5	R10	P1
001	FL RADIO	NOT EQUIPPED	NOT EQUIPPED	DETAIL A
002	DM RADIO	1N4454	470	DETAIL B

TABLE B [4]

OPTION 001		OPTION 002	
P1	WIRE COLOR	P1	WIRE COLOR
1	BK	A	SHLD
2	BR	B	WH-BK
3	OR	C	WH-R
4	-	D	BK
5	-	E	CNTR COND
6	YEL	F	BR
7	GN	H	-
8	BL	J	R
9	VIO	K	OR
10	SL	L	-
11	WH	M	-
12	WH-BK	N	-
13	R	P	-
14	WH-R	R	-
15	-	S	BL
		T	GN
		U	SL
		V	WH

ATE METER WITH
VOLTAGE OUTPUT
WER SUPPLY ONLY
AVING SET THIS
WITH A DIGITAL
OLTMETER

ALIBRATE
TR XMTR
B
PWR

D-83218-M2

LAST NO. USED

R10, CR5, TP2

TI NOT REQUIRED

[ ]	DENOTES PRINTED BOARD MARKINGS.
□	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—•—	REFERS TO CIRCUIT JUNCTION POINTS.
SYM	DESCRIPTION
LEGEND	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL: —
FINISH: —
PROCESS: —
USED ON: FL & DM. RADIO

SCALE NONE | ENGR. BY BGN | APP'VD. RJ
DATE 8-18-75 | DRAWN BY RH | APP'VD.

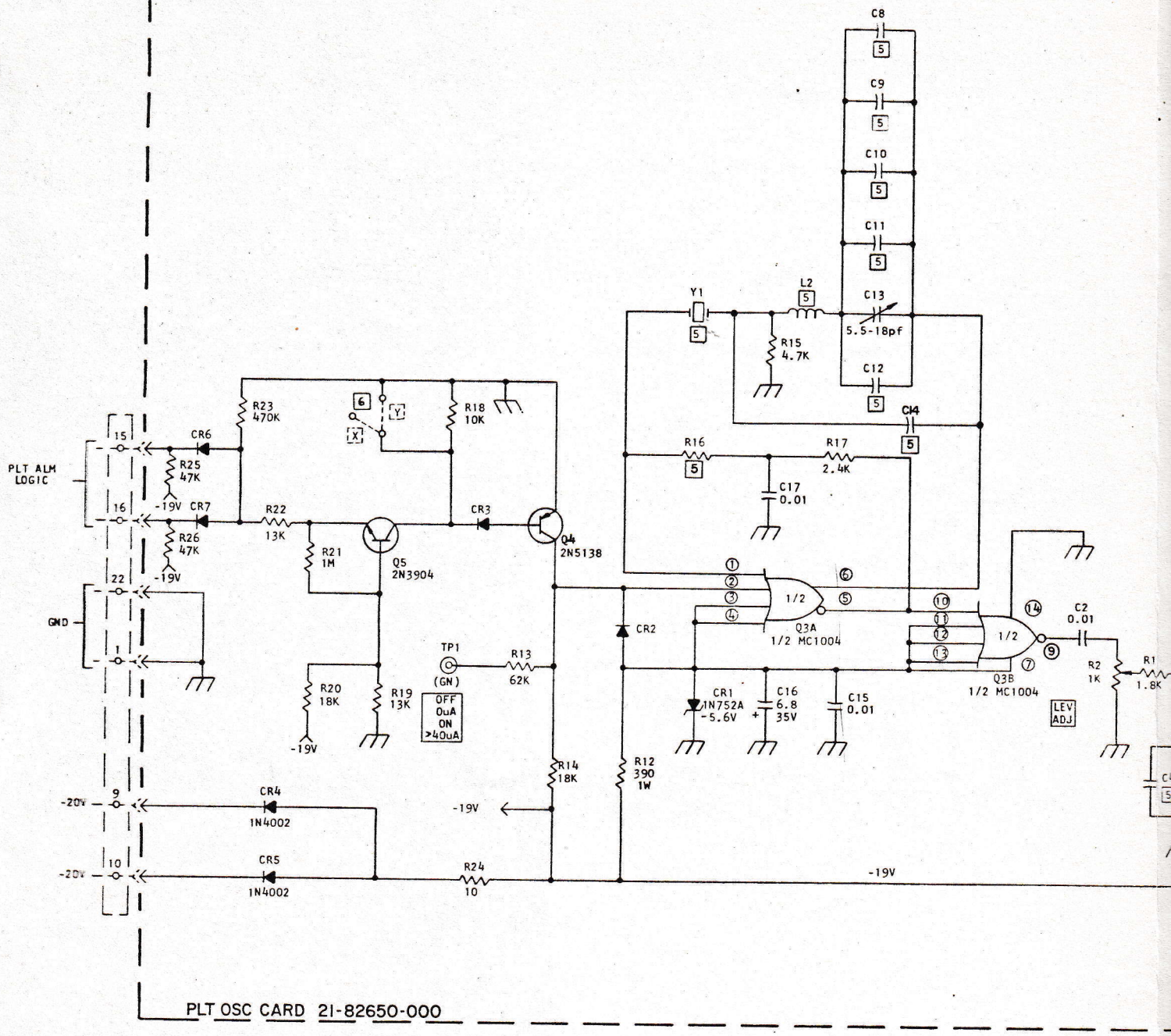
Farinon

METER PANEL

ORIG. RH
DIST. RJ
SHEET / OF / SHEETS
DWG SIZE

SD-83218-M2 D

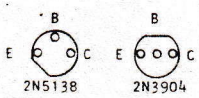
-M2



[6] FOR STRAPPING ARRANGEMENTS SEE TABLE B.

[5] EQUIPMENT OPTIONS ARE PER TABLE A.

4. TRANSISTOR BASE CONFIGURATIONS:



3. UNLESS OTHERWISE SPECIFIED DIODES ARE 1N4454.

2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, ±5%. CAPACITORS ARE IN MICROFARADS AND INDUCTORS ARE IN MICROHENRIES.

NOTES:

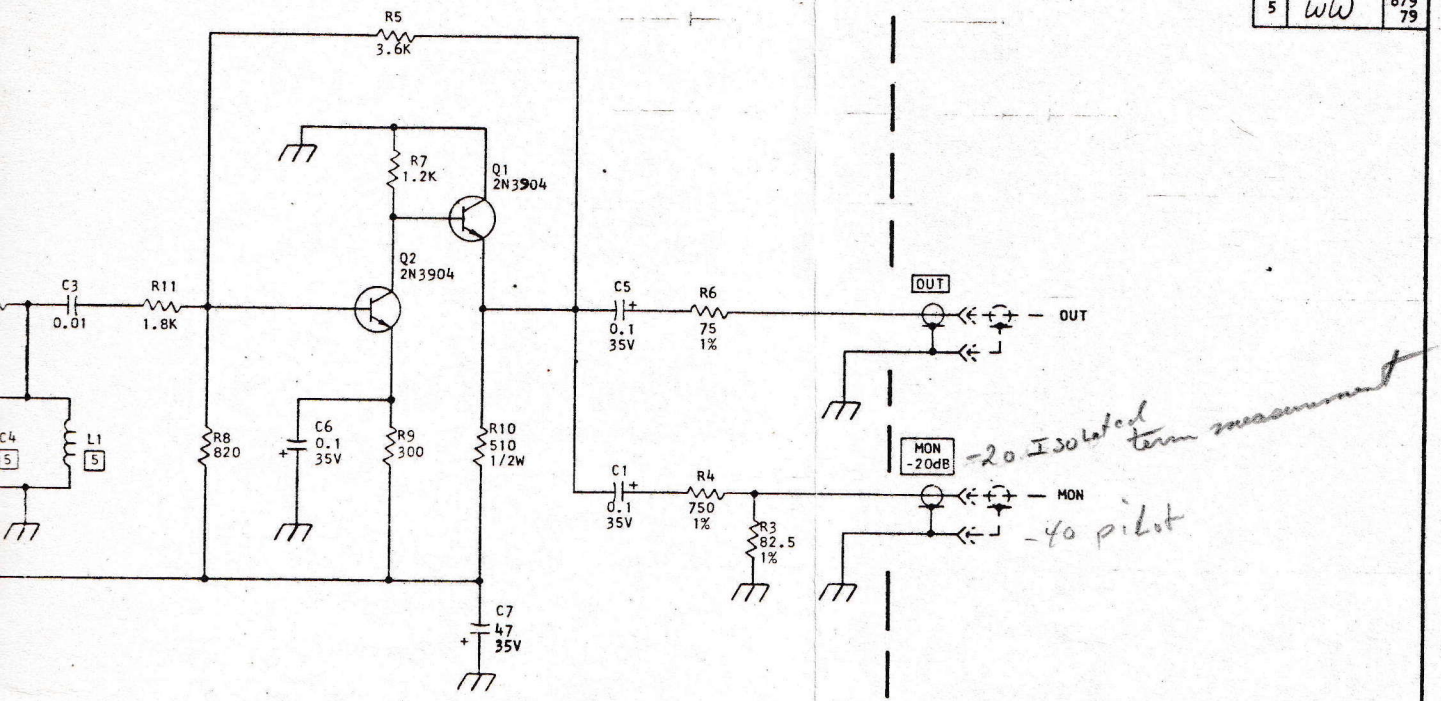
TABLE B [6]

OPT.	APPLICATION
X	PREVIOUS RCVR PLT ALM KEYS PLT OSC ON (FOR RPTR WITH THRU PLT). OR, FOR USE WITH CONTINUITY PLT SWITCH PANEL SD-83298. OR, LOOP SYSTEMS EQUIPPED WITH BB INTERFACE AND LOOP SWITCH SD-83226.
Y	PLT ALWAYS ON (FOR TERM AND FOR RPTR WITHOUT THRU PLT). OR, TEST MODE FOR RPTR WITH THRU PILOT.

TABLE A [5]

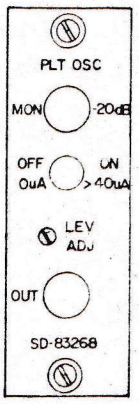
OPTION	PILOT FREQ KHz	Y1 KHz	C4 pF	C8 pF	C9 pF	C10 pF	C11 pF	C12 pF	C14 uF
001	607	607	1300	-	-	-	-	-	.01
002	1499	1499	414	-	-	-	-	-	.01
003	1975	1975	271	-	-	-	-	-	.01
004	3200	3200	246	-	-	-	-	-	.01
005	4715	4715	510	12	12	12	12	15	—
006	6199								
007	6800								
008	8500	8500	300	-	-	12	12	43	-
009	9023	9023	270	-	-	12	12	33	-
010	11880								
011	331	331	2260	-	-	-	-	-	.01

SD-83268			
REVISIONS			
ISSUE	APPROVED		DATE
1	[illegible]	YK	6-5-76
C1 WAS (BL). DRAFTING ERROR.			
1A	[illegible]	[illegible]	[illegible]
OPTS 001 THRU 004 & 011 ADDED. ECN 5753			
2	[illegible]		12/6 77
TBL B CLARIFIED ECN 6010.			
	A	[illegible]	4/10 78
OPTION -005 COMPONENT VALUES ADDED. (KIT #099-004715-102). ECN 6184.			
3		HP	6/8 78
OPTION -005 CHGS; ADD C8, & C9 -12pF; C12 WAS 43 pF; L2 WAS 10 µH; R16 WAS 1K OHM. ECN 6314.			
4			9/14 78
C7 WAS 6.8. ECN 6831.			
5		WW	8/9 79



-20 Isolated term measurement

-40 pilot



L1 uH	L2 uH	R16 Ω	KIT NUMBER
51	-	1K	099-000607-102
27	-	1K	099-001499-102
27	-	1K	099-001975-102
10	-	1K	099-003200-102
2.2	1S	56	099-004715-102
1.2	5.6	56	099-008500-102
1.2	5.6	56	099-009023-102
100	-	7.5K	099-000331-102

LAST NO. USED

R26, Q5, CR7, L2, C17, Y1, TP1

NUMBERS OMITTED

SYM	DESCRIPTION / LEGEND
[illegible]	DENOTES PRINTED BOARD MARKING.
[illegible]	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—•—	REFERS TO CIRCUIT JUNCTION POINT.

ISSUE NO. CROSS REFERENCE

SD	1	2	3	4	5				
TI	1	1	1	1	1				

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA ± .003"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL: N/
FINISH: N/
PROCESS: N/
USED ON: FH, FL, FM2000

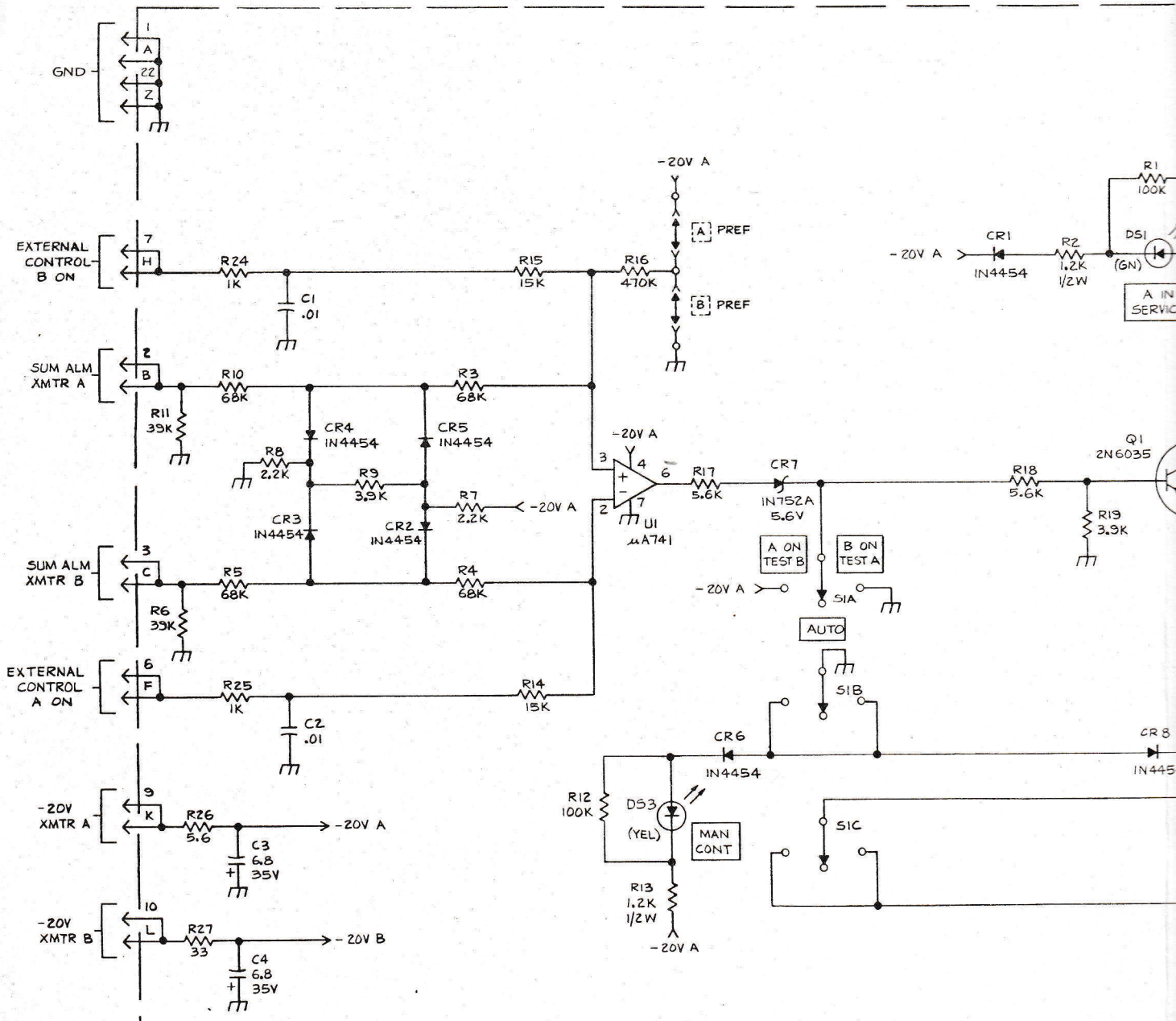
SCALE NONE | ENGR BY HP | APP'VD.
DATE 9-15-76 | DRAWN BY RH | APP'VD.

Farinon

PLT OSC

ORIG. [illegible] | SHEET / OF / SHEETS | DWG SIZE
DIST. K

SD-83268 | D



MHSB CONTROL (RELAY SWITCH) CARD 021-82696

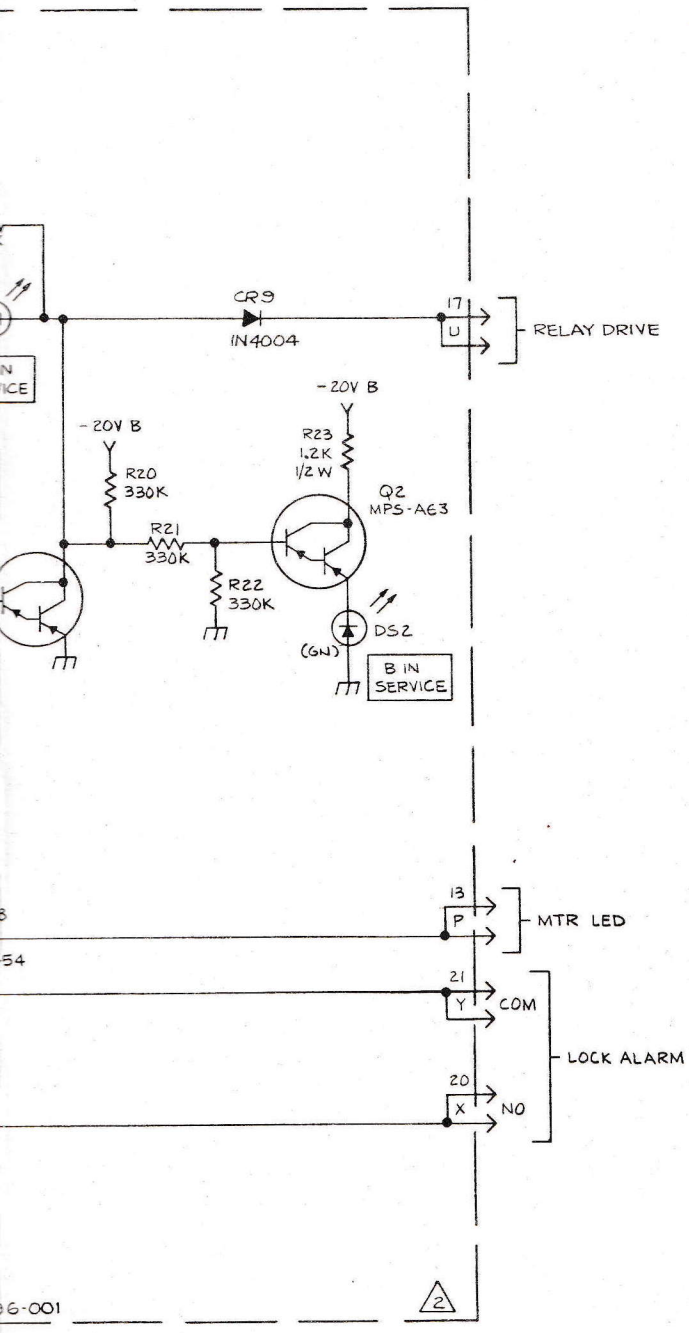
[3] STRAPPING OPTIONS ARE PER TABLE A.

COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ±5%, 1/4W; 1% RESISTORS ARE 1/8W, AND CAPACITOR VALUES ARE IN MICROFARADS.

NOTES:

SD-84201		
REVISIONS		
ISSUE	APPROVED	DATE
1	WW	5-23-79
Q2 WAS MPSA66. ECN 6882.		
2	[illegible]	10/15/79
CR1 ADDED. PC BD WAS ISS. 1. ECN 6985.		
3	WW	11/19/79



LAST NUMBERS USED
U1, Q2, S1, DS3, CR8, C4, R27

TABLE A [3]

APPLICATION	OPTION
XMTR PREFERRED	A
XMTR PREFERRED	B

ISSUE NUMBER CROSS REFERENCE

SD	1	2	3
TI	1	1	1

SYM	DESCRIPTION
	DENOTES PRINTED BOARD MARKING.
	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
	REFERS TO CIRCUIT JUNCTION POINT.

LEGEND

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64"
ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .002"

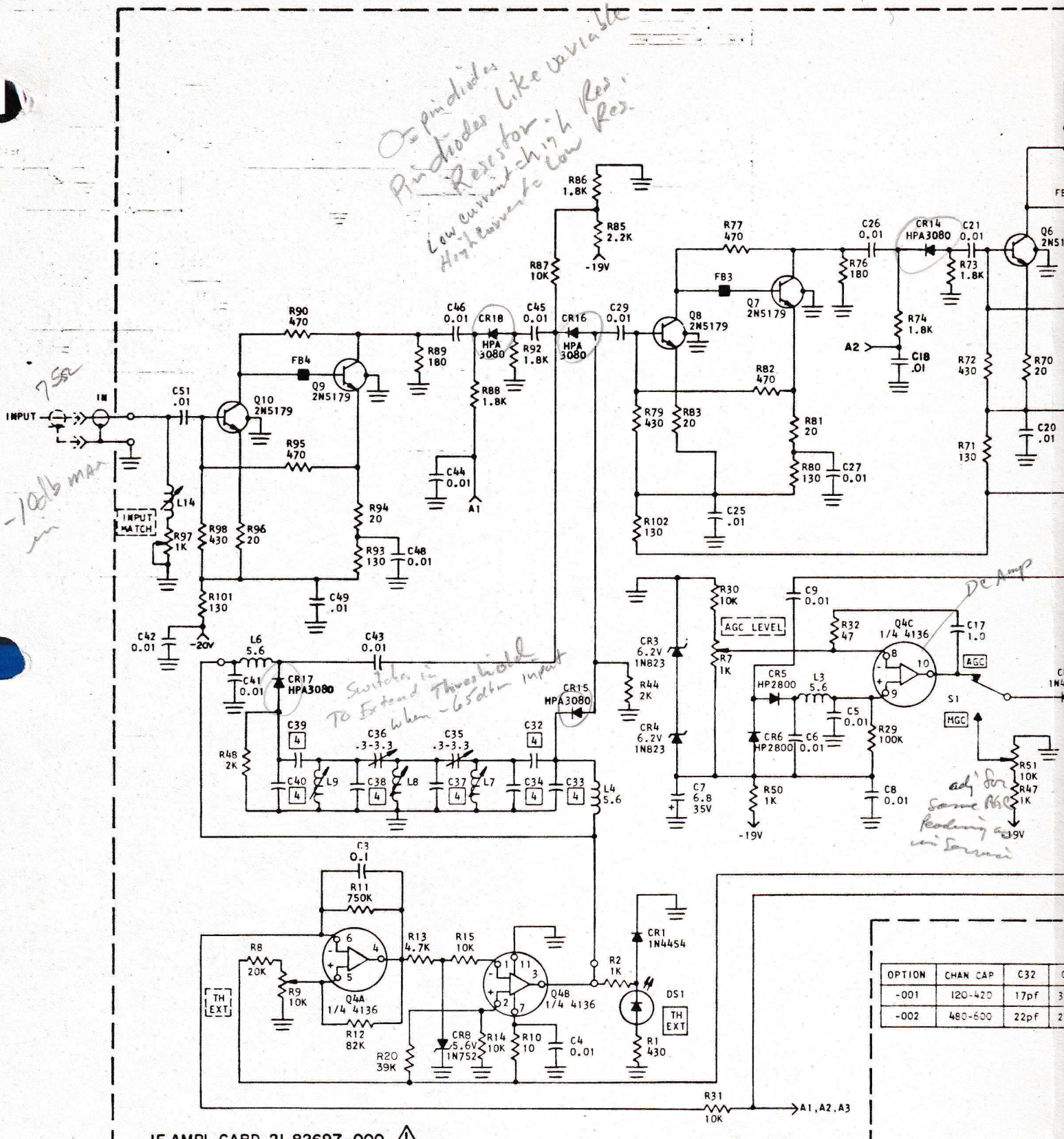
MATERIAL:
FINISH:
PROCESS:
USED ON: FLI-2

SCALE —	ENGR. BY HP	APP'VD.
DATE 9-8-78	DRAWN BY VJ	APP'VD.

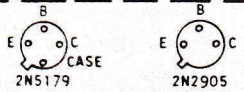
Farinon

MHSB CONTROL (RELAY SWITCH)

ORIG.	SHEET | OF | SHEETS	DWG. SIZE
DIST. K		
SD-84201		D



OPTION	CHAN CAP	C32	
-001	120-420	17pf	3
-002	480-600	22pf	2



2. TRANSISTOR BASE CONFIGURATION. 2N5179

3. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

NOTES:

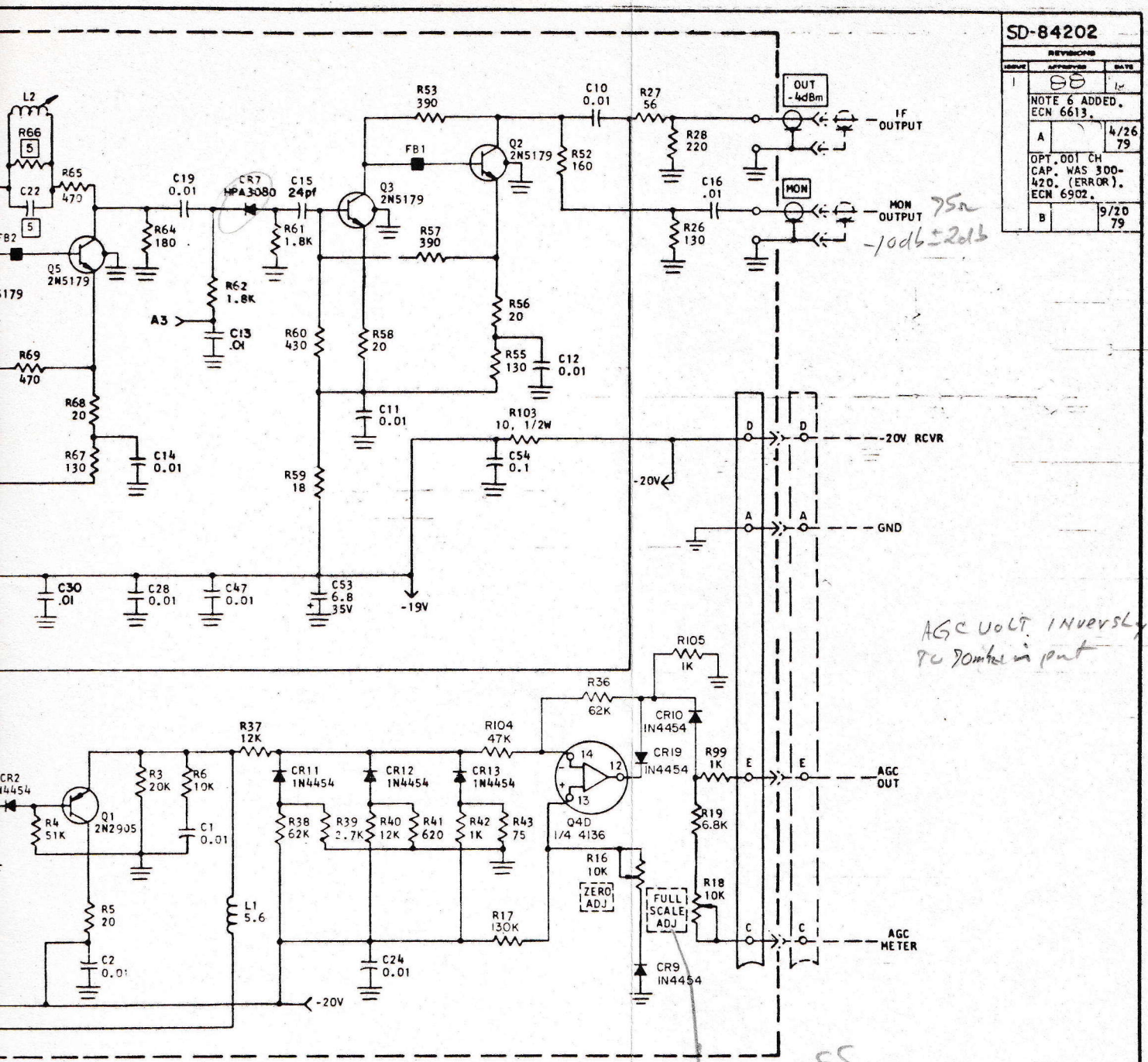
1. UNLESS OTHERWISE STATED, ALL RESISTORS ARE IN OHMS 1/4W ± 5%, CAPACITORS ARE IN MICROFARADS AND INDUCTORS ARE IN MICROHENRIES.

6. HPA 3080 DIODES MAY BE MARKED WITH ALTERNATE SYMBOLS.

[5] FACTORY SELECT NOM. VALUE R66 470Ω, C22-6 pF.

[4] SEE TABLE A.

SD-84202



SD-84202

REVISIONS

ISSUE	APPROVED	DATE
1	SB	12
	NOTE 6 ADDED. ECN 6613.	
	A	4/26 79
	OPT.001 CH CAP. WAS 300-420. (ERROR). ECN 6902.	
	B	9/20 79

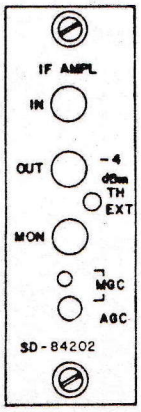
75Ω
-10db ±2db

AGC VOLT INVERSLY Proportional TO Zombie input

-3db min for F.S.

TABLE A [4]

C33	C34	C37	C38	C39	C40
30pf	15pf	27pf	15pf	12pf	33pf
27pf	10pf	22pf	10pf	17pf	30pf



LAST NO. USED

CR19, Q10, L14, DS1, S1, C54, R103, FB4

ISSUE NO. CROSS REFERENCE

SD	1										
TI	1										

SYM	DESCRIPTION
	DENOTES PRINTED BOARD MARKING.
	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
	REFERS TO CIRCUIT JUNCTION POINT.
	LEGEND

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE: 2 PLACE DECIMALS ± .010" 3 PLACE DECIMALS ± .005" FRACTIONAL DIMENSIONS ± 1/64" ANGULAR DIMENSIONS ± 1° HOLES UNDER .250 DIA ± .000"

MATERIAL:
FINISH:
PROCESS:
USED ON: FLI-2,6 & 7

SCALE NONE | ENGR BY WJ | APP'VD
DATE 3-4-77 | DRAWN BY CR | APP'VD

Farinon

IF AMPL

DWG. FSK | SHEET 1 OF 1 SHEETS
SIZE B

SD-84202 D

REVISIONS

ISSUE	APPROVED	DATE
1	RK	8-30 78
OPTION 002 ADDED. ECN 6331.		
2		9/15 78
-20/-21V WAS -21V. ECN 6729.		
A	WW	6/28 79
OPTION 003 ADDED. ECN 6812.		
3	WW	7/26 79

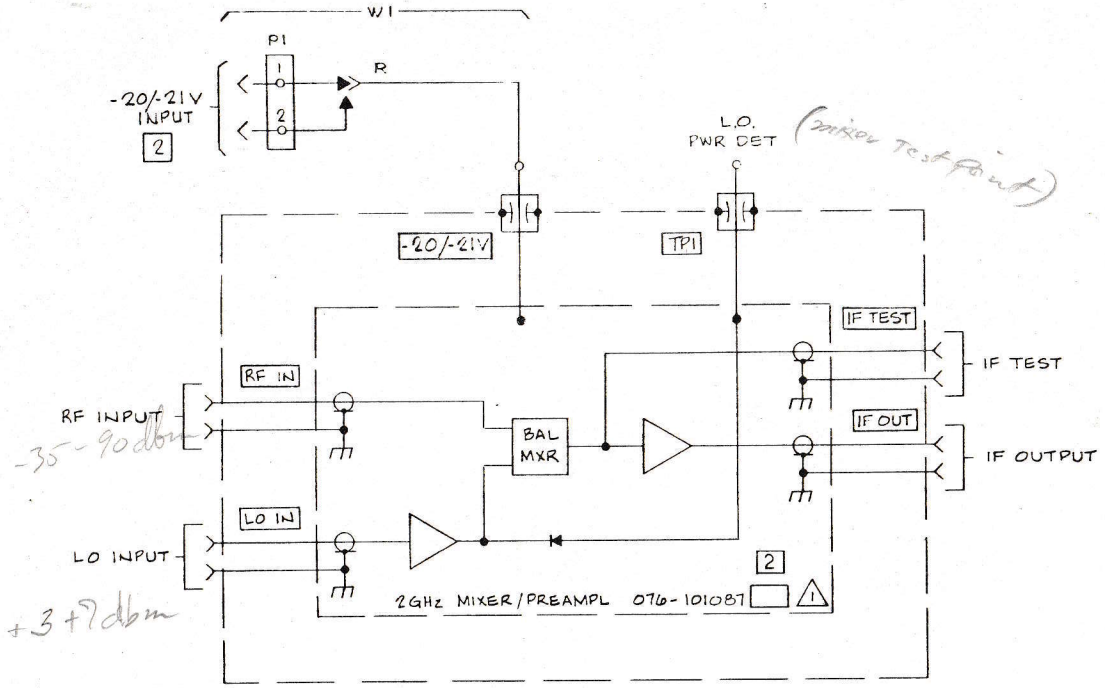


TABLE A [2]

OPTION	FREQ. RANGE	MIXER PREAMPL.	INPUT VOLTAGE/ P1 PIN NUMBER	WHERE USED
001	2.0-2.3 GHz	076-101087-001	-21V/PIN 1	RL46
002	1.7-2.0 GHz	076-101087-002	-20V/PIN 2	FL1-2
003	1.7-2.0 GHz	076-101087-002	-21V/PIN 1	RL-46

T1 NOT REQUIRED

3. RF INPUT LEVEL -8 dBm, MAXIMUM
   LOCAL OSCILLATOR INPUT LEVEL +3 dBm, MINIMUM,+6 dBm MAXIMUM
   IF OUTPUT FREQUENCY 70 MHz
   INPUT IMPEDANCE 50 OHMS, UNBALANCED
   OUTPUT, IMPEDANCE 75 OHMS, UNBALANCED
   BANDWIDTH (70 MHz CENTER FREQUENCY) 50 MHz NOMINAL AT 3 dB POINTS
   CONVERSION GAIN 23 dB NOMINAL, 22 dB MINIMUM
   DSB NOISE FIGURE 10 dB NOMINAL, 12 dB MAXIMUM

[2.] EQUIPMENT OPTIONS PER TABLE A.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ±5%, 1/4W AND CAPACITOR VALUES ARE IN PICOFARADS. INDUCTOR VALUES IN MICROHENRIES.

NOTES:

SYM	DESCRIPTION
	DENOTES PRINTED BOARD MARKING.
	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—•—	REFERS TO CIRCUIT JUNCTION POINT.

LEGEND

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .010" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64" | ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .002"

MATERIAL:
FINISH:
PROCESS:
USED ON: 100086 (RL46)/101242(FL1-2)

SCALE — | ENGR. BY JB | APP'VD. RK
DATE 3-29-78 | DRAWN BY MSH | APP'VD.

Farinon

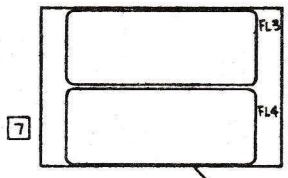
MIXER/PRE-AMPLIFIER

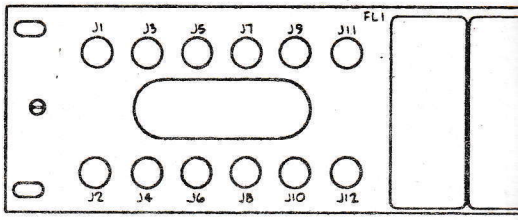
ORIG. | SHEET | OF | SHEETS | DWG SIZE
PRINT R

SD-100084 C

TABLE A [1]

OPTION	CUSTOMER CONNECTIONS	ACCESSORY PROVISIONS [2]
001	CONNECTORIZED, AT P2 (W1 NOT EQPD, TB1 EQPD AS SPARE)	12 BNC BLKHD CONN 2 FILTERS 2 ALARM EXTENDERS
002	WIREWRAP, AT TB1	
003	CONNECTORIZED, AT P2 (W1 NOT EQPD, TB1 EQPD AS SPARE)	12 BNC BLKHD CONN 4 FILTERS (EXTENDER J4, J5, J13, J14, NOT EQPD.)
004	WIREWRAP, AT TB1	





10 NOT USED IN FL1-2 SYSTEM.

9 SEE TABLE C FOR OPTIONAL RADIO ALARM CONNECTIONS AVAILABLE ON PANEL OPTIONS -001 & -002 WHEN SD-83273 ALARM EXTENDERS ARE EQUIPPED.

8 ON NON-PROTECTED SYSTEM 'B' RADIO CONNECTIONS APPLY ONLY TO REPEATER ASSEMBLIES.

7 PROVISIONS FOR FL3 & FL4 ARE INCLUDED IN PLACE OF ALARM EXTENDERS FOR OPTIONS 003 & 004.

6 PROVIDES FOR LOCAL PILOT GENERATION IN CASE RECEIVER PILOT IS LOST DUE TO DEEP FADING OR EQUIPMENT MALFUNCTION. USED AT REPEATER SITE ONLY. "EAST" RACK NODAN/PLT LOGIC ALM A AND B RESPECTIVELY MUST BE CONNECTED TO "WEST" RACK PILOT ALM LOGIC INPUT A AND B RESPECTIVELY. "EAST" RACK PLT ALM LOGIC INPUT A AND B RESPECTIVELY MUST BE CONNECTED TO "WEST" RACK NODAN/PLT LOGIC ALM A AND B RESPECTIVELY.

5 CONNECTED ONLY WHEN AUX SHELF SD-83015 IS INCLUDED ON RACK (BAY) AND WHEN AUX BB AMPLIFIERS SD-83158 ARE FITTED TO AUX SHELF.

4 CONNECTED ONLY WHEN AUX SHELF SD-83015 IS INCLUDED ON RACK AND WHEN ORDERWIRE SD-83159 IS FITTED TO AUX SHELF.

3 SEE TABLE B FOR TB1 OR P2 AND TB2 PIN ASSIGNMENTS. ON OPTIONS -001 & -003, TB1 CAN BE USED FOR MISC. RACK WIRING AS REQUIRED. ON ALL OPTIONS, TB2, A1-A10, B1-B10, C1-C10, D1-D10, E1-E6 CAN BE USED FOR MISC. WIRING.

2 SPECIFY PART NUMBER (042-020063-250) QUANTITY AND MOUNTING POSITIONS FOR BNC BULKHEAD CONNECTORS. SEE SD-19797 FOR COAXIAL FILTERS AND SD-83273 FOR ALARM EXTENDER.

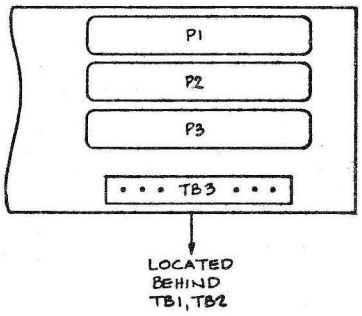
1 EQUIPMENT OPTIONS ARE PER TABLE A.

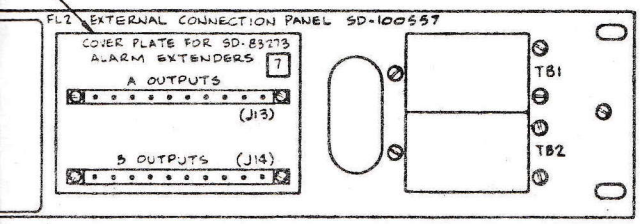
NOTES:

SD-100557

SD-100557

REVISIONS			
ISSUE	APPROVED	DATE
1	RK	3-27 78
	NOTE 10 ADDED. MISC. CORRECTIONS THRUOUT DRAWING. ECN 6380.	
	A	10/9 78
TBL C & SHEET 3: J13 & J14 WERE REVERSED. (ERROR). PIN ASSIGNMENTS TO J13, J14 & P1 CORRECTED. ECN 6656.		
2		4/24 79
	SPARE A & B CONN'S WERE REV. (ERROR) ECN 6745.	
	A	6-28 79





BASIC PANEL
FRONT VIEW W/O COVER

TI NOT REQUIRED

SYM	DESCRIPTION
	LEGEND
[ ]	DENOTES PRINTED BOARD MARKING.
□	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
—o—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—•—	REFERS TO CIRCUIT JUNCTION POINT.

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER 250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON:

SCALE	ENGR. BY JS	APP'VD. JS
DATE 3-3-78	DRAWN BY MA	APP'VD. RK

Farinon

EXTERNAL CONNECTION PANEL

CRIG. DIST. K	SHEET 1 OF 3 SHEETS	DWG SIZE
SD-100557		D

TABLE 8 [3]

CUSTOMER CONNECTIONS - STANDARD ALARMS

ALARM DESIGNATION			LOCATION	
PROTECTED SYSTEM TERMINAL	LOOP SYSTEM	NON-PROTECTED SYSTEM [8]	OPTIONS -001 & -003	OPTIONS -002 & -004
XMTR LOGIC ALM NC OR NO	—	—	P2-1	TBJ-A2
XMTR LOGIC ALM COM [10]	—	—	P2-25	TB1-E10
GROUND	GROUND	GROUND	P2-2	TB1-B2
XMTR RESET [10]	XMTR A SUM ALM	XMTR A SUM ALM	P2-3	TB1-C2
PWR SUPPLY A ALM NC OR NO	PWR SUPPLY A ALM NC OR NO	PWR SUPPLY A ALM NC OR NO	P2-4	TB1-D2
PWR SUPPLY A ALM COM [10]	PWR SUPPLY A ALM COM [10]	PWR SUPPLY A ALM COM [10]	P2-5	TB1-E2
PWR SUPPLY B ALM NC OR NO	PWR SUPPLY B ALM NC OR NO	PWR SUPPLY B ALM NC OR NO	P2-6	TB1-A4
PWR SUPPLY B ALM COM [10]	PWR SUPPLY B ALM COM [10]	PWR SUPPLY B ALM COM [10]	P2-7	TB1-B4
XMTR A SUM ALM NC OR NO	XMTR A SUM ALM NC OR NO	XMTR A SUM ALM NC OR NO	P2-8	TB1-C4
XMTR A SUM ALM COM	XMTR A SUM ALM COM	XMTR A SUM ALM COM	P2-9	TB1-D4
RCVR A AGC OUT	RCVR A AGC OUT	RCVR A AGC OUT	P2-10	TB1-E4
RCVR A SUM ALM NC OR NO	RCVR A SUM ALM NC OR NO	RCVR A SUM ALM NC OR NO	P2-11	TB1-A6
RCVR A SUM ALM COM	RCVR A SUM ALM COM	RCVR A SUM ALM COM	P2-12	TB1-B6
XMTR B SUM ALM NC OR NO	XMTR B SUM ALM NC OR NO	XMTR B SUM ALM NC OR NO	P2-13 [8]	TB1-C6 [8]
XMTR B SUM ALM COM	XMTR B SUM ALM COM	XMTR B SUM ALM COM	P2-14	TB1-D6
RCVR B AGC OUT	RCVR B AGC OUT	RCVR B AGC OUT	P2-15 [8]	TB1-E6 [8]
RCVR B SUM ALM NC OR NO	RCVR B SUM ALM NC OR NO	RCVR B SUM ALM NC OR NO	P2-16 [8]	TB1-A8 [8]
RCVR B SUM ALM COM	RCVR B SUM ALM COM	RCVR B SUM ALM COM	P2-17	TB1-B8
—	BLOCK A	—	P2-18	TB1-C8
—	BLOCK B	—	P2-19	TB1-D8
—	LOOP SW A ALM NC OR NO	—	P2-20	TB1-E8
—	LOOP SW A ALM COM	—	P2-21	TB1-A10
—	LOOP SW B ALM NC OR NO	—	P2-22	TB1-B10
—	LOOP SW B ALM COM	—	P2-23	TB1-C10
RCVR RESET	XMTR B SUM ALM	XMTR B SUM ALM	P2-24 [8]	TB1-D10 [8]
XMTR LOCK ALM COM	—	—	P2-26	TB1-A1
XMTR LOCK ALM NC OR NO	—	—	P2-27	TB1-B1
SET RCVR A ON	—	—	P2-28	TB1-C1
SET XMTR A ON	—	—	P2-29	TB1-D1
RCVR LOCK ALM COM	—	—	P2-30	TB1-E1
RCVR LOCK ALM NC OR NO	—	—	P2-31	TB1-A3
XMTR AMPL A ALM NC OR NO	XMTR AMPL A ALM NC OR NO	XMTR AMPL A ALM NC OR NO	P2-32 [5]	TB1-B3 [5]
XMTR AMPL A ALM COM	XMTR AMPL A ALM COM	XMTR AMPL A ALM COM	P2-33 [5]	TB1-C3 [5]
XMTR AMPL B ALM NC OR NO	XMTR AMPL B ALM NC OR NO	XMTR AMPL B ALM NC OR NO	P2-34 [5]	TB1-D3 [5]
XMTR AMPL B ALM COM	XMTR AMPL B ALM COM	XMTR AMPL B ALM COM	P2-35 [5]	TB1-E3 [5]
OW EXT AUD SIG NC OR NO	OW EXT AUD SIG NC OR NO	OW EXT AUD SIG NC OR NO	P2-36 [4]	TB1-A5 [4]
OW EXT AUD SIG COM	OW EXT AUD SIG COM	OW EXT AUD SIG COM	P2-37 [4]	TB1-B5 [4]
OW FUSE ALM NC OR NO	OW FUSE ALM NC OR NO	OW FUSE ALM NC OR NO	P2-38 [4]	TB1-C5 [4]
OW FUSE ALM COM	OW FUSE ALM COM	OW FUSE ALM COM	P2-39 [4]	TB1-D5 [4]
RCVR AMPL A ALM NC OR NO	RCVR AMPL A ALM NC OR NO	RCVR AMPL A ALM NC OR NO	P2-40 [5]	TB1-E5 [5]
RCVR AMPL A ALM COM	RCVR AMPL A ALM COM	RCVR AMPL A ALM COM	P2-41 [5]	TB1-A7 [5]
RCVR AMPL 3 ALM NC OR NO	RCVR AMPL B ALM NC OR NO	RCVR AMPL B ALM NC OR NO	P2-42 [5]	TB1-B7 [5]
RCVR AMPL B ALM COM	RCVR AMPL B ALM COM	RCVR AMPL B ALM COM	P2-43 [5]	TB1-C7 [5]
OW ALM MON INPUT	OW ALM MON INPUT	OW ALM MON INPUT	P2-44 [4]	TB1-D7 [4]
SET XMTR B ON	—	—	P2-45	TB1-E7
SET RCVR B ON	—	—	P2-46	TB1-A9
—	PASS B	—	P2-1	TB1-A2
—	LOOP PLT B ALM	—	TB2-E8	TB2-E8
—	LOOP PLT A ALM INHIBIT	—	TB2-E9	TB2-E9
—	LOOP PLT A ALM INHIBIT	—	TB2-E10	TB2-E10
—	PASS A	—	P2-28	TB1-C1
—	LOOP PLT A ALM	—	TB2-F2	TB2-F2
—	SPARE A	—	TB2-F4	TB2-F4
—	SPARE B	—	TB2-F3	TB2-F3
—	LOOP PLT B ALM INHIBIT	—	TB2-F5	TB2-F5
—	LOOP PLT B ALM INHIBIT	—	TB2-F6	TB2-F6
PILOT LOGIC B IN	PILOT LOGIC B IN	PILOT LOGIC B IN	TB2-F7 [6] [8]	TB2-F7 [6] [8]
PILOT LOGIC A IN	PILOT LOGIC A IN	PILOT LOGIC A IN	TB2-F8 [6]	TB2-F8 [6]
PILOT NODAN B ALM	PILOT NODAN B ALM	PILOT NODAN B ALM	TB2-F9 [6] [8]	TB2-F9 [6] [8]
PILOT NODAN A ALM	PILOT NODAN A ALM	PILOT NODAN A ALM	TB2-F10 [6]	TB2-F10 [6]

REVISIONS			
ISSUE		APPROVED	DATE
1		YK	3-27-78
	A	99	10-9-78
2		AP	4-24-79
	A	WW	6-28-79

TABLE C [3]

CUSTOMER CONNECTIONS - OPTIONAL ALARMS [9]

ALARM DESIGNATION			LOCATION
PROTECTED SYSTEM TERMINAL	LOOP SYSTEM	NON-PROTECTED SYSTEM [8]	OPTION -001 & -002
XMTR A PLT ALM N.O.	XMTR A PLT ALM N.O.	XMTR A PLT ALM N.O.	J13-13
XMTR A PLT ALM COM	XMTR A PLT ALM COM	XMTR A PLT ALM COM	J13-14
XMTR A AFC ALM N.O.	XMTR A AFC ALM N.O.	XMTR A AFC ALM N.O.	J13-15
XMTR A AFC ALM COM	XMTR A AFC ALM COM	XMTR A AFC ALM COM	J13-16
XMTR A PWR ALM N.O.	XMTR A PWR ALM N.O.	XMTR A PWR ALM N.O.	J13-17
XMTR A PWR ALM COM	XMTR A PWR ALM COM	XMTR A PWR ALM COM	J13-18
RCVR A PLT ALM N.O.	RCVR A PLT ALM N.O.	RCVR A PLT ALM N.O.	J13-19
RCVR A PLT ALM COM	RCVR A PLT ALM COM	RCVR A PLT ALM COM	J13-20
RCVR A NODAN ALM N.O.	RCVR A NODAN ALM N.O.	RCVR A NODAN ALM N.O.	J13-21
RCVR A NODAL ALM COM	RCVR A NODAN ALM COM	RCVR A NODAN ALM COM	J13-22
XMTR B PLT ALM N.O.	XMTR B PLT ALM N.O.	XMTR B PLT ALM N.O.	J14-21
XMTR B PLT ALM COM	XMTR B PLT ALM COM	XMTR B PLT ALM COM	J14-22
XMTR B AFC ALM N.O.	XMTR B AFC ALM N.O.	XMTR B AFC ALM N.O.	J14-19
XMTR B AFC ALM COM	XMTR B AFC ALM COM	XMTR B AFC ALM COM	J14-20
XMTR B PWR ALM N.O.	XMTR B PWR ALM N.O.	XMTR B PWR ALM N.O.	J14-17
XMTR B PWR ALM COM	XMTR B PWR ALM COM	XMTR B PWR ALM COM	J14-18
RCVR B PLT ALM N.O.	RCVR B PLT ALM N.O.	RCVR B PLT ALM N.O.	J14-15
RCVR B PLT ALM COM	RCVR B PLT ALM COM	RCVR B PLT ALM COM	J14-16
RCVR B NODAN ALM N.O.	RCVR B NODAN ALM N.O.	RCVR B NODAN ALM N.O.	J14-13
RCVR B NODAN ALM COM	RCVR B NODAN ALM COR	RCVR B NODAN ALM COM	J14-14

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA ± .004"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON:

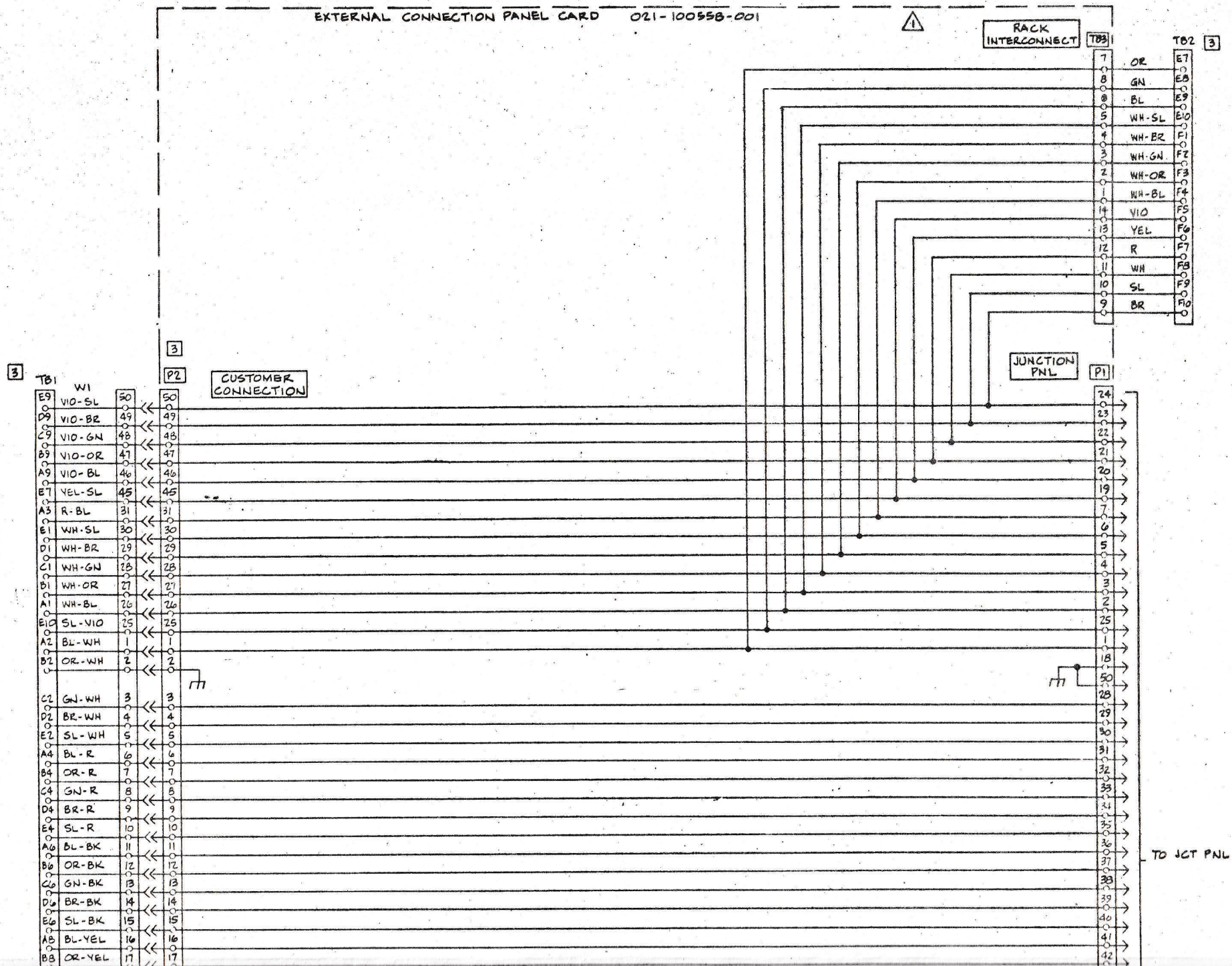
SCALE ——	ENGR BY JS	APPVD
DATE 3-29-78	DRAWN BY MSH	APPVD

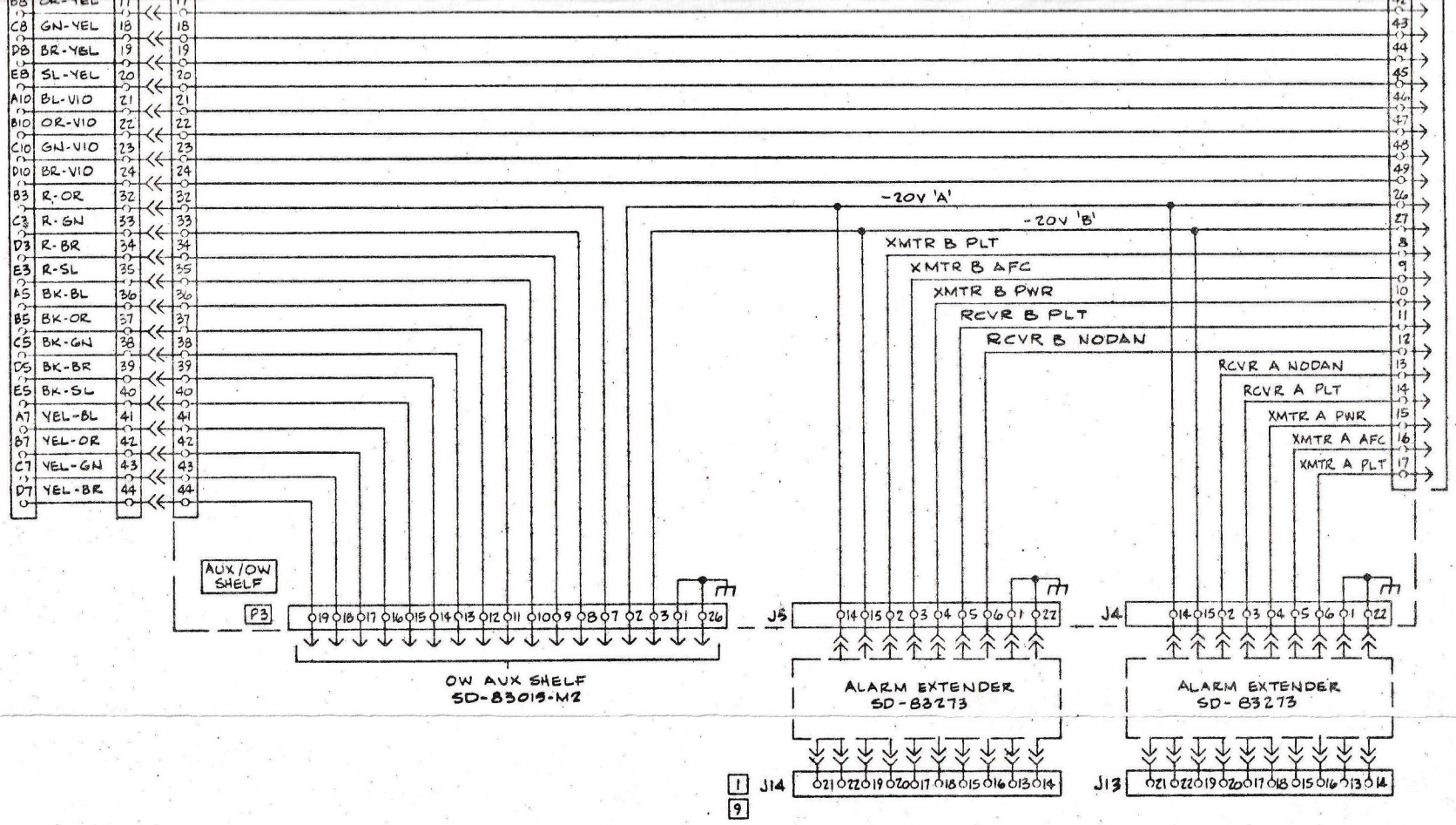
Farinon

EXTERNAL CONNECTION PANEL

ORIG. DIST.		SHEET 2 OF 3 SHEETS	DWG SIZE
	K		

SD-100557 D


EXTERNAL CONNECTION PANEL CARD 021-100558-001
1
RACK INTERCONNECT
TB3
TB2
3
7 OR E7
8 GN E8
9 BL E9
5 WH-SL E10
4 WH-BR F1
3 WH-GN F2
2 WH-OR F3
1 WH-BL F4
14 VIO F5
13 YEL F6
12 R F7
11 WH F8
10 SL F9
9 BR F10
JUNCTION PNL
P1
TB1
W1
P2
CUSTOMER CONNECTION
E9 VIO-SL 50 50
D9 VIO-BR 49 49
C9 VIO-GN 48 48
B9 VIO-OR 47 47
A9 VIO-BL 46 46
E7 YEL-SL 45 45
A3 R-BL 31 31
E1 WH-SL 30 30
D1 WH-BR 29 29
C1 WH-GN 28 28
B1 WH-OR 27 27
A1 WH-BL 26 26
E10 SL-VIO 25 25
A2 BL-WH 1 1
B2 OR-WH 2 2
C2 GN-WH 3 3
D2 BR-WH 4 4
E2 SL-WH 5 5
A4 BL-R 6 6
B4 OR-R 7 7
C4 GN-R 8 8
D4 BR-R 9 9
E4 SL-R 10 10
A6 BL-BK 11 11
B6 OR-BK 12 12
C6 GN-BK 13 13
D6 BR-BK 14 14
E6 SL-BK 15 15
A8 BL-YEL 16 16
B8 OR-YEL 17 17
24 23 22 21 20 19 7 6 5 4 3 2 25 1 18 50 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
TO JCT PNL
SD-100557



ORIG.	K	SHEET 3 OF 3 SHEETS	SIZE D
SUPT.			

SD-100557

EXTERNAL CONNECTION PANEL

Farinon

SCALE		ENGR BY	JS
DATE	3-16-78	DRAWN BY	MSH
		APPVD.	
		APPVD.	

USED ON:

PROCESS:

FINISH:

MATERIAL:

ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
3 PLACE DECIMALS ± .015"
2 PLACE DECIMALS ± .030"
FRACTIONAL DIMENSIONS ± 1/64"
ANGULAR DIMENSIONS ± 1°
HOLES UNDER .250 DIA. ± .005"

SD-100557

REVISIONS

ISSUE	APPROVED	DATE
1		
A	RK	3-27-78
2	RK	10-9-78
A	WW	4-24-79
		6-28-79

TABLE A [1] [4]

OPTION	FIG.	DESCRIPTION	OLD PART NO. REF.	LINE IMPEDANCE	APPROX. CROSSOVER FREQUENCY	PASSBAND				BAND
						LP RANGE	I.L. dB	HP RANGE	I.L. dB	BP RANGE
081-19797-001	1	252/260 KHz SPLTG & COMB	081-19789-001	75Ω	256 KHz	0-252 KHz	0.1	260 KHz - 10 MHz	0.1	
081-19797-002	1	56/60 KHz SPLTG & COMB	081-16880-001	75Ω	58 KHz	0-56 KHz	0.1	60 KHz - 10 MHz	0.05	
081-19797-003	2	284 KHz L.P.	081-16881-001	75Ω		0-284 KHz	0.1			
081-19797-004	4	56/60 KHz SPLTG & COMB	081-16887-001	75Ω	58 KHz	0-56 KHz	0.7	60 KHz - 10 MHz	0.7	
081-19797-005	2	1364 KHz L.P.	081-16888-001	75Ω		0-1364 KHz	0.1			
081-19797-006	2	1796 KHz L.P.	081-16889-001	75Ω		0-1796 KHz	0.1			
081-19797-007	2	2792 KHz L.P.	081-16890-001	75Ω		0-2792 KHz	0.1			
081-19797-008	2	3500 KHz L.P.	081-16891-001	75Ω		0-3500 KHz	0.2			
081-19797-009	2	6 MHz L.P.	081-16892-001	75Ω		0-6.0 MHz	0.1			
081-19797-010	2	308 KHz B.P.	081-16482-001	SEE REMARKS						308 KHz
081-19797-011	2	64 KHz B.P.	081-17655-001	SEE REMARKS						64 KHz
081-19797-012	1	300/312 KHz SPLTG & COMB	081-17612-001	75Ω	306 KHz	0-300 KHz	1.50	312 KHz - 6 MHz	1.50	
081-19797-013	3	CCIRR TV PRE-EMPHASIS	081-17658-001	75Ω						10 KHz T 12 MHz
081-19797-014	3	CCIRR TV DE-EMPHASIS	081-17659-001	75Ω						70 KHz T 10 MHz
081-19797-015	2	552 KHz L.P.	081-17768-001	75Ω		0-552 KHz	0.10			
081-19797-016	1	552/564 KHz SPLTG & COMB	081-17769-001	75Ω	560 KHz	0-552 KHz	3.0	564 KHz - 6.0 MHz	3.10	
081-19797-017	3	PRE-EMPHASIS	081-17691-001	75Ω						40 KHz 4 MHz
081-19797-018	3	DE-EMPHASIS	081-17692-001	75Ω						40 KHz 4 MHz
081-19797-019	2	6.0 MHz L.P.	081-17717-001	75Ω		0-6.0 MHz	0.05			
081-19797-020	3	PRE-EMPHASIS	081-17693-001	75Ω						40 KHz 8 MHz
081-19797-021	3	DE-EMPHASIS	081-17694-001	75Ω						40 KHz 8 MHz
081-19797-022	2	5.780 MHz L.P.	081-18814-001	75Ω		0-5.78 MHz	0.5			
081-19797-023	3	PRE-EMPHASIS	081-18995-001	75Ω						100 KHz 2.66 MHz
081-19797-024	3	DE-EMPHASIS	081-18996-001	75Ω						100 KHz 2.66 MHz
081-19797-025	3	PRE-EMPHASIS	081-17707-01	75Ω						100 KHz 8.0 MHz
081-19797-026	3	DE-EMPHASIS	081-17708-001	75Ω						100 KHz 8.0 MHz
081-19797-027	2	204 KHz LP	—	75Ω		0-204 KHz	0.1			
081-19797-028	1	188/196 KHz SPLTG & COMB	—	75Ω	192 KHz	0.188 KHz	0.10	196 KHz-4500 KHz	0.10	
081-19797-029	2	108 KHz LP	—	75Ω		0-108 KHz	0.10			
081-19797-030	1	60/68 KHz SPLTG & COMB	—	75Ω	64 KHz	0-60 KHz	0.15	68 KHz-4500 KHz	.15	
081-19797-031	1	92/100 KHz SPLTG	—	75Ω	96 KHz	0-92 KHz	.2	100 - 4500 KHz	.15	
081-19797-032	1	124/132 KHz SPLTG	—	75Ω	128 KHz	0-124 KHz	.15	132 - 4500 KHz	.15	
081-19797-033	1	156/164 KHz SPLTG	—	75Ω	160 KHz	0-156 KHz	.15	164 - 4500 KHz	.15	
081-19797-034	1	28/36 KHz SPLTG	—	75Ω	32 KHz	0-28 KHz	.15	36 - 4500 KHz	.15	
081-19797-035	2	1998 KHz LP	—	75Ω		0-1998 KHz	.6			
081-19797-036	3	PRE-EMPHASIS	—	75Ω						100 KHz 1.796 MHz
081-19797-037	3	DE-EMPHASIS	—	75Ω						100 KHz 1.796 MHz
081-19797-038	5	1052 KHz LP	—	75Ω		0-1052 KHz	1.0			
081-19797-039	1	12/20 KHz SPLTG & COMB	—	75Ω	16 KHz	0-12 KHz	.2	20-6000 KHz	.15	
081-19797-040	2	188 KHz LP	—	75Ω		0-188 KHz	.1			

(TABLE CONTINUED ON SHEET 2)

NOTES:

[1] EQUIPMENT OPTIONS ARE PER TABLE A.

[2] THESE FILTERS ARE DESIGNED TO BE USED INDIVIDUALLY AND NORMALLY ARE NOT TO BE FLANKED WITH ANOTHER FILTER.

[3] THESE FILTERS ARE DESIGNED TO FLANK WITH EACH OTHER AND ARE NOT TO BE USED INDIVIDUALLY.

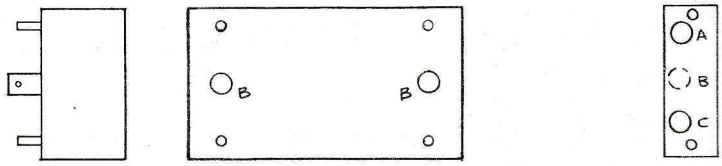
[4] ALL I. L. FIGURES GIVEN IN TABLE A ARE ACTUAL FILTER POWER LOSSES AT REFERENCE FREQUENCY GIVEN IN FILTER SPEC SHEET EXCEPT OPTIONS 010, 011, 057, 060 & 066.

[5] FILTERS PER FIGURE 5 ~~OCCUPY~~ 4 POSITIONS ON MOUNTING PANEL. SEE DETAIL B.

[6] 3000-4506 KHz RL > 22 dB.

[7] INSERTION LOSS AT 312KHz.

[8] INSERTION LOSS AT 68 KHz.



[5] DETAIL B

SD-19797

NDPASS GE	I.L. dB	REMARKS
		RL > 26 dB IN PASSBAND
		RL > 24 dB (60.6 KHz -10 MHz)
		STOPS 312 KHz PILOT
		RL > 24 dB (60.6 KHz -10 MHz) ATTENUATION EQ. IN L.P. & H.P.
		STOPS 1499 KHz PILOT
		STOPS 1975 KHz PILOT
		STOPS 3200 KHz PILOT
		STOPS 4715 KHz PILOT
		STOPS 8.5 MHz PILOT
Hz	23.5	INPUT AMUST BRIDGE 75Ω LINE OUTPUT Z = 75Ω
Hz	22.7	INPUT AMUST BRIDGE 75Ω LINE OUTPUT Z = 75Ω
		308 KHz 2 dB DOWN FROM 1 MHz
TO Hz	13	
TO Hz	13	
		STOPS 607 KHz PILOT
Hz	12	EQUIVALENT WECO-226 AD
MHz	1.56	
KHz	0.0	EQUIVALENT WECO-226 AE
MHz	10.5	
		50 dB 8.1-8.5 MHz RL > 23 dB 0-6.0 MHz
KHz	13.95	EQUIVALENT WECO 457D
MHz	2.94	
KHz	.38	EQUIVALENT WECO 457E
MHz	11.11	
		RL > 23 dB 0-5.780 MHz STOPS 7.5 MHz, 8.5 MHz
KHz	9.00	CCIR - 600 CH
MHz	1.00	
KHz	0.0	CCIR - 600 CH
MHz	8.0	
KHz	8.95	CCIR - 1500 CH
MHz	.35	
KHz	0.0	CCIR - 1500 CH
MHz	8.60	
		RL > 23 dB IN PASSBAND, STOPS 331 KHz PLT
		RL > 23 dB IN PASSBAND
		RL > 23 dB IN PASSBAND, STOPS 119 KHz PLT
		RL > 25 dB IN PASSBAND
		RL > 25 dB IN PASSBAND
		RL > 24 dB IN PASSBAND [6]
		RL > 25 dB IN PASSBAND
		RL > 25 dB IN PASSBAND
Hz MHz	8.98 1.05	CCIR - 420 CH
Hz MHz	0.0 8.0	CCIR - 420 CH
		RL > 25 dB IN PASSBAND
		RL > 25 dB IN PASSBAND
		RL > 25 dB IN PASSBAND, STOPS 331 KHz PLT

FIG 1 [3]

LINE SEPERATION FILTER

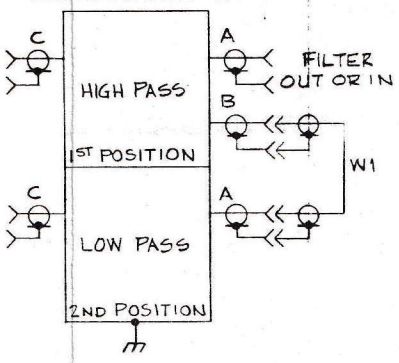


FIG 2 [2]

HP, LP OR BP FILTER

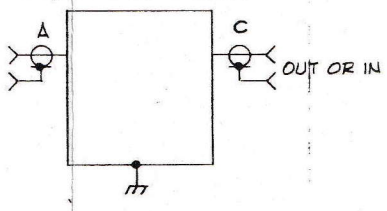


FIG 3

EMPHASIS

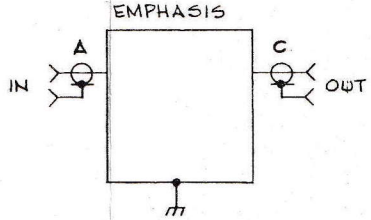
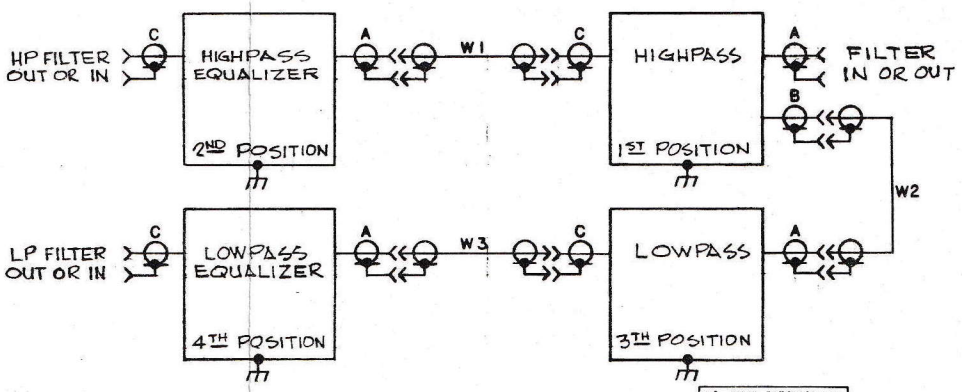
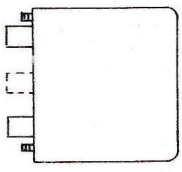


FIG 4 [3]



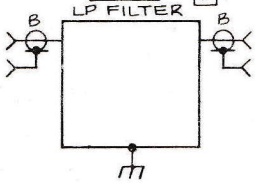
T1 NOT REQUIRED



DETAIL A

FIG 5 [5]

LP FILTER



SD-19797 REVISIONS		
ISSUE	APPROVED	DATE
1	ZH	12/24/75
OPTS. 028 THRU 030 ADDED PER ECN 3981.		
2	ZH	5/17 76
OPTS 31 THRU 34 ADDED. ECN 4255.		
3	PD	9/13 76
OPTS. -035 THRU -040 ADDED PER ECN 5067.		
4	PD	8/18 77
OPTIONS 041 THRU 052 ADDED PER ECN 5394.		
5	PD	10/18 77
OPTIONS -053 & -054 ADDED. ECN 5713.		
6	PD	1/20 77
OPTIONS -056,-057, -059, THRU -062 ADDED. ECN 6222.		
7	PD	7/6 78
OPTS. 055 & 063 THRU 067 ADDED. ECN 6652.		
8	PD	4/19 79
OPTS. 068 THRU 070 ADDED. ECN 6929.		
9	PD	10/15 79
OPT. 071 ADDED. ECN 7178.		
10	PD	4/30 80

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
3 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
2 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: 16876, 18720, 19461

SCALE —	ENGR. BY P.D.	APP'VD. PD
DATE 12-8-75	DRAWN BY DOOMS	APP'VD. RK

Farinon

COAXIAL FILTERS

ORIG. P.E.	SHEET 1 OF 2 SHEETS	DWG. SIZE
DIST. M		
SD-19797		D

TABLE A (CONT.)

OPTION	FIG.	DESCRIPTION	OLD PART NO. REF.	LINE IMPEDANCE	APPROX CROSSOVER FREQUENCY	PASSBAND				BANDP
						LP RANGE	I.L. dB	HP RANGE	I.L. dB	BP RANGE
081-19797-041	3	PRE-EMPHASIS	-	75Ω	-	-	-	-	-	60 KHz 1300 KHz
081-19797-042	3	DE-EMPHASIS	-	75Ω	-	-	-	-	-	60 KHz 1300 KHz
081-19797-043	3	PRE-EMPHASIS	-	75Ω	-	-	-	-	-	60 KHz 2044 KHz
081-19797-044	3	DE-EMPHASIS	-	75Ω	-	-	-	-	-	60 KHz 2044 KHz
081-19797-045	3	PRE-EMPHASIS	-	75Ω	-	-	-	-	-	12 KHz 300 KHz
081-19797-046	3	DE-EMPHASIS	-	75Ω	-	-	-	-	-	12 KHz 300 KHz
081-19797-047	3	PRE-EMPHASIS	-	75Ω	-	-	-	-	-	12 KHz 552 KHz
081-19797-048	3	DE-EMPHASIS	-	75Ω	-	-	-	-	-	12 KHz 552 KHz
081-19797-049	3	PRE-EMPHASIS	-	75Ω	-	-	-	-	-	12 KHz 1052 KHz
081-19797-050	3	DE-EMPHASIS	-	75Ω	-	-	-	-	-	12 KHz 1052 KHz
081-19797-051	2	316 KHz L.P.	-	75Ω	-	.3-316 KHz	1.0	-	-	-
081-19797-052	2	156 KHz L.P.	-	75Ω	-	.3-156 KHz	.1	-	-	-
081-19797-053	2	1300 KHz L.P.	-	75Ω	-	.3-1300 KHz	.1	-	-	-
081-19797-054	1	8/12 KHz SPLTG & COMB.	-	75Ω	10 KHz	.3-8 KHz	.1	12 KHz-10 MHz	.1	-
081-19797-055	1	204/212 KHz SPLTG	-	75Ω	208 KHz	0-204 KHz	1.0	212 KHz-10 MHz	1.0	-
081-19797-056	2	108 KHz LP	-	75Ω	-	.3-108 KHz	.6	-	-	-
081-19797-057	2	60 KHz BP	-	SEE REMARKS	-	-	-	-	-	60 KHz
081-19797-058										
081-19797-059	2	124 KHz LP	—	75Ω	-	0-124 KHz	.1	-	-	-
081-19797-060	2	308 KHz BE	—	75Ω	—	0-300 KHz	.5	312-10000 KHz	[7] .9	—
081-19797-061	2	408 KHz LP	—	75Ω	—	0-408 KHz	.1	-	-	-
081-19797-062	2	3.2 KHz LP	—	75Ω	—	0-3.2 KHz	1.5	-	-	-
081-19797-063	1	108/116 KHz SPLTG	—	75Ω	112 KHz	0-108 KHz	1.2	116-6000 KHz	1.2	-
081-19797-064	2	64 KHz HP	—	75Ω	—	—	—	64-1000 KHz	.80	-
081-19797-065	1	3/4 KHz SPLTG	—	75Ω	3.5 KHz	0-3 KHz	.15	4-3000 KHz	.20	-
081-19797-066	2	64 KHz B E	—	75Ω	—	0-60 KHz	.25	68-3000 KHz	.25 [8]	-
081-19797-067	2	2044 KHz LP	—	75Ω	—	0-2044 KHz	0.8	-	-	-
081-19797-068	1	408/440 KHz SPLTG	—	75Ω	420 KHz	.3-408 KHz	.1	440-6000 KHz	.1	—
081-19797-069	3	PREEMPHASIS	—	75Ω	—	—	—	—	—	10 KHz 8.0 MHz
081-19797-070	3	DEEMPHASIS	—	75Ω	—	—	—	—	—	10 KHz 8.0 MHz
081-19797-071	2	6.7 KHz LP	081-102111-01	75Ω	—	.3-6.7 KHz	1.0	—	—	—

DPASS		
E	I.L. dB	REMARKS
	8.9	CCIR 300 CH
	1.03	
	0.0	CCIR 300 CH
	7.9	
	8.95	CCIR 480 CH
	1.0	
	0.0	CCIR 480 CH
	7.97	
	8.95	CCIR 72 CH
	1.0	
	0.0	CCIR 72 CH
	7.99	
	8.97	CCIR 132 CH
-	.99	
	0.0	CCIR 132 CH
	7.97	
	8.95	CCIR 252 CH
	.99	
	0.0	CCIR 252 CH
	7.98	
	-	STOPS 331 KHz PILOT RL > 23 IN PASSBAND
	-	STOPS 331 KHz PILOT RL > 25 IN PASSBAND
	-	STOPS 1975 KHz PILOT RL > 26 dB IN PASSBAND
	-	RL > 24 dB IN PASSBAND
	-	RL > 24 dB IN PASSBAND
	-	RL > 26 dB IN PASSBAND, STOPS 119 KHz PLT
	23.5	INPUT A MUST BRIDGE 75Ω LINE, OUTPUT: 75Ω
	-	RL > 26 dB IN PASSBAND, STOPS 331 KHz PLT
	—	30 dB ATTEN. BETWEEN 307.7-308.3 KHz
	-	RL > 25 dB IN PASSBAND, STOPS 607 KHz PLT
	-	RL > 23 dB IN PASSBAND
	-	RL > 26 dB IN PASSBAND
	-	RL > 22 dB IN PASSBAND
	-	RL > 24 dB IN PASSBAND
	-	40 dB ATTEN. BTWN 63.6- 64.4 KHz
	-	RL > 20 dB IN PASSBAND STOPS 3200 KHz PILOT
	—	RL 24 dB IN PASSBAND, STOPS 607 KHz PLT
	14	CCIR TV625 LINES
	0.0	
	0.0	CCIR TV625 LINES
	14	
	—	.5 dB MAX. ATT. AT 6.7 KHz 8-6000 KHz > 63 dB ATT.

SD-19797		
REVISIONS		
ISSUE	APPROVED	DATE
5	PD	11/2 77
6	PD	1/20 78
7	PD	7-6 78
8	PD	4/19 79
9	PD	10/15 79
10	PD	4/30 80

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ±1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: 16876, 18720, 19461

SCALE —	ENGR. BY P.D.	APP'VD.
DATE 10-18-77	DRAWN BY JRO	APP'VD.

Farinon

COAXIAL FILTERS

ORIG. DIST. M	SHEET 2 OF 2 SHEETS	DWG. SIZE
SD-19797		D

TABLE A [2]

"T" PAD RESISTOR VALUES

OPTION	ATTEN dB	R1 - R2	R3
005	0.5	2.15	1300
010	1	4.32	649
015	1.5	6.49	432
020	2	8.66	324
025	2.5	10.7	255
030	3	12.7	213
035	3.5	15	182
040	4	16.9	158
045	4.5	19.1	140
050	5	21	124
055	5.5	22.6	110
060	6	24.9	100
065	6.5	26.7	90.9
070	7	28.7	84.5
075	7.5	30.9	76.8
080	8	32.4	71.5
085	8.5	33.2	64.9
090	9	34.8	60.4
095	9.5	36.5	56.2
100	10	38.3	52.3
105	10.5	40.2	48.7
110	11	43.2	46.4
115	11.5	44.2	43.2
120	12	45.3	40.2
125	12.5	45.3	37.4
130	13	48.7	35.7
135	13.5	48.7	33.2
140	14	48.7	30.9
145	14.5	51.1	29.4
150	15	52.3	27.4
155	15.5	53.6	26.1
160	16	53.6	24.3
165	16.5	53.6	22.6
170	17	56.2	21.5
175	17.5	57.6	20.5
180	18	57.6	19.1
185	18.5	59	18.2
190	19	60.4	16.9
195	19.5	60.4	16.2
200	20	61.4	15
205	20.5	61.9	14.3
210	21	64.9	13.7
215	21.5	63.4	12.7
220	22	64.9	12.1
225	22.5	64.9	11.3
230	23	64.9	10.7
235	23.5	64.9	10
240	24	66.5	9.53
245	24.5	64.9	8.87
250	25	66.5	8.45
260	26	68.1	7.5
270	27	68.1	6.65
280	28	69.8	6.04
290	29	69.8	5.36
300	30	69.8	4.75
310	31	69.8	4.22
320	32	69.8	3.74
330	33	73.2	3.4
340	34	73.2	3.01
350	35	73.2	2.67
400	40	73.2	1.5

[4]

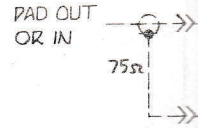
[4]

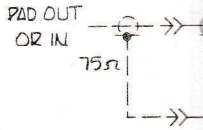
TABLE B [2]

"PI" PAD RESISTOR VALUES

OPTION	ATTEN dB	R4 - R5	R6
005	0.5	2610	4.32
010	1	1300	8.66
015	1.5	866	13
020	2	649	17.4
025	2.5	523	22.1
030	3	442	26.7
035	3.5	374	30.9
040	4	332	35.7
045	4.5	294	40.2
050	5	267	45.3
055	5.5	243	51.1
060	6	226	56.2
065	6.5	210	61.9
070	7	196	66.5
075	7.5	182	73.2
080	8	174	78.7
085	8.5	165	86.6
090	9	158	93.1
095	9.5	150	100
100	10	143	107
105	10.5	140	115
110	11	133	121
115	11.5	130	130
120	12	124	140
125	12.5	121	150
130	13	118	158
135	13.5	115	169
140	14	113	182
145	14.5	110	191
150	15	107	205
155	15.5	105	215
160	16	102	232
165	16.5	102	243
170	17	100	261
175	17.5	97.6	274
180	18	97.6	294
185	18.5	95.3	309
190	19	93.1	332
195	19.5	93.1	348
200	20	90.9	374
205	20.5	90.9	392
210	21	88.7	422
215	21.5	88.7	442
220	22	88.7	464
225	22.5	86.6	499
230	23	86.6	523
235	23.5	86.6	562
240	24	84.5	590
245	24.5	84.5	634
250	25	84.5	665
260	26	82.5	750
270	27	82.5	845
280	28	80.6	931
290	29	80.6	1050
300	30	80.6	1180
310	31	78.7	1330
320	32	78.7	1500
330	33	78.7	1690
340	34	78.7	1870
350	35	76.8	2100
400	40	76.8	3740
000	0	OPEN	STRAP

[4]





SD-100278

SD-100278		
REVISIONS		
ISSUE	APPROVED	DATE
1	[illegible]	6-7-77
OPT. 000 ADDED PER ECN 5228.		
2	[illegible]	8/18/77

FIG. 1 [3]

"T" PAD

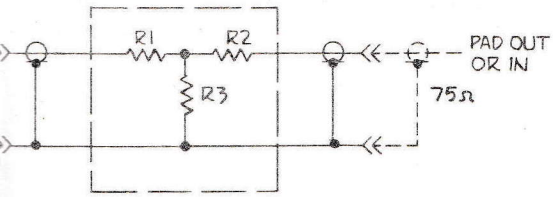
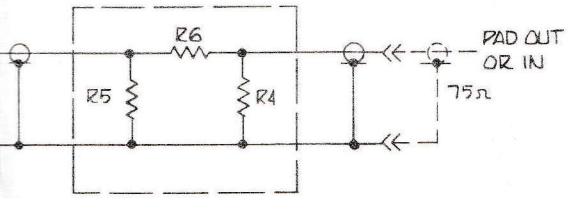
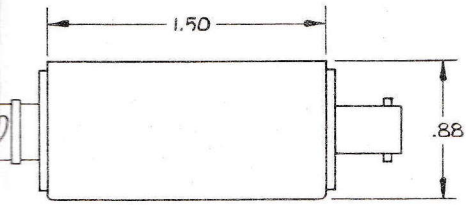


FIG. 2 [3]

"PI" PAD





[4] PAD VALUES REQUIRING RESISTORS OF LESS THAN 10.1Ω ARE AVAILABLE ON SPECIAL ORDER ONLY.

[3] RESISTANCE VALUES DEPENDENT ON ATTENUATION REQUIRED. SEE TABLE A OR B.

[2] "T" PADS AND "PI" PADS MAY BE INTERCHANGED AT FACTORY OPTION.

1. ALL RESISTORS ARE 1% METAL FILM T-0 TEMP COEF.

NOTES:

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA ± .002"
FRACTIONAL DIMENSIONS ±1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON:

SCALE	ENGR. BY F.H.	APP'VD.
DATE 5/5/77	DRAWN BY J.R.O.	APP'VD. RK

Farinon

75 OHM COAXIAL RESISTIVE PADS

ORIG.	SHEET 1 OF 1 SHEETS	DWG. SIZE
DIST.		
SD-100278		D

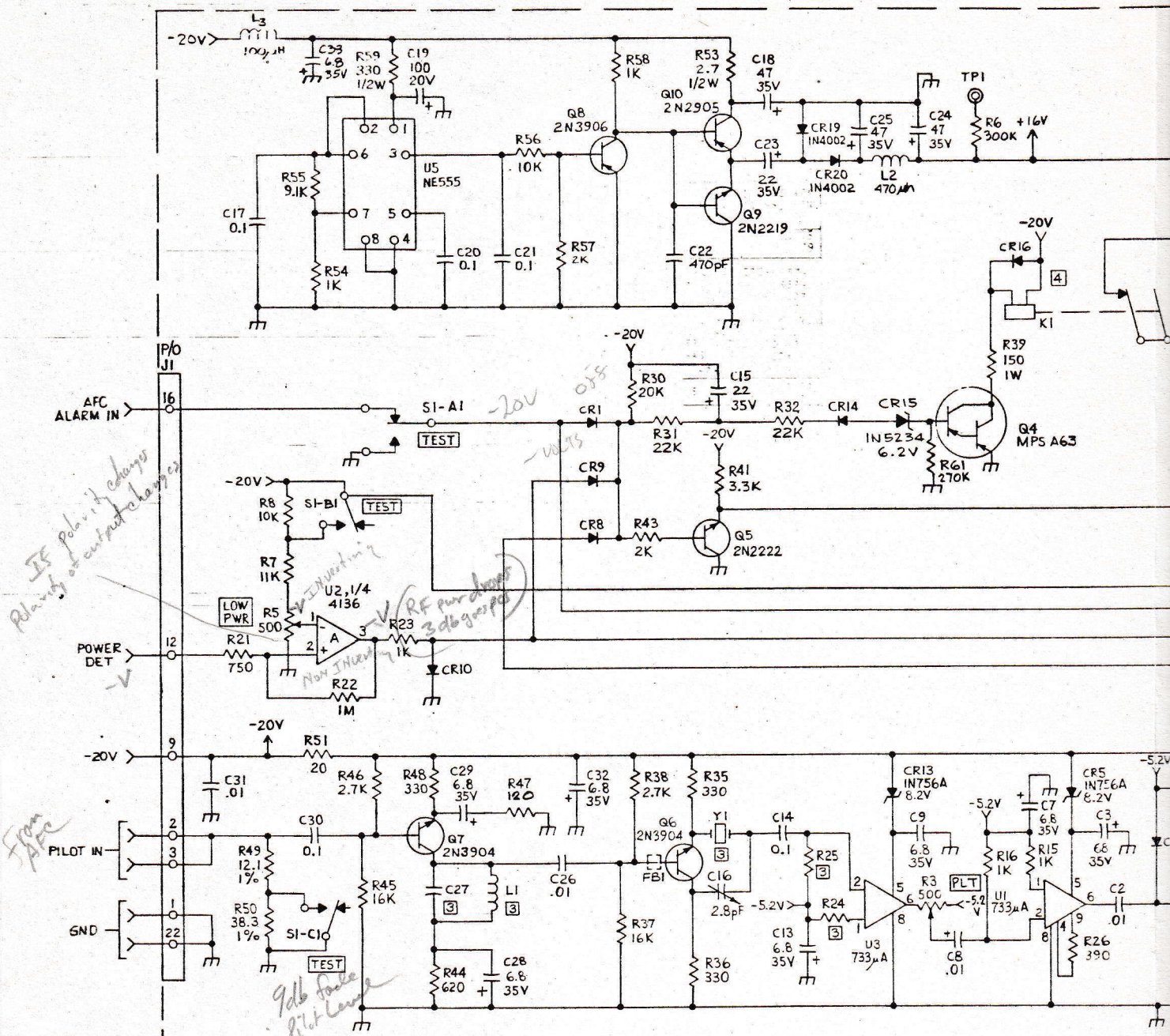


TABLE A [3]

OPTION	PILOT FREQ KHz	Y1 KHz	L1 µH	C27 pF	R24,25 OHMS	KIT NO.
001	331	331	100	2260	10,000	099-000331-203
002	607	607	51	1300	5,600	099-000607-203
003	1499	1499	18	604	1,000	099-001499-203
004	1975	1975	18	360	1,000	099-001975-203
005	3200	3200	5.6	430	1,000	099-003200-203

[5] STRAPPING OPTIONS ARE PER TABLE B.

[4] RELAY SHOWN IN ENERGIZED (NORMAL) STATE.

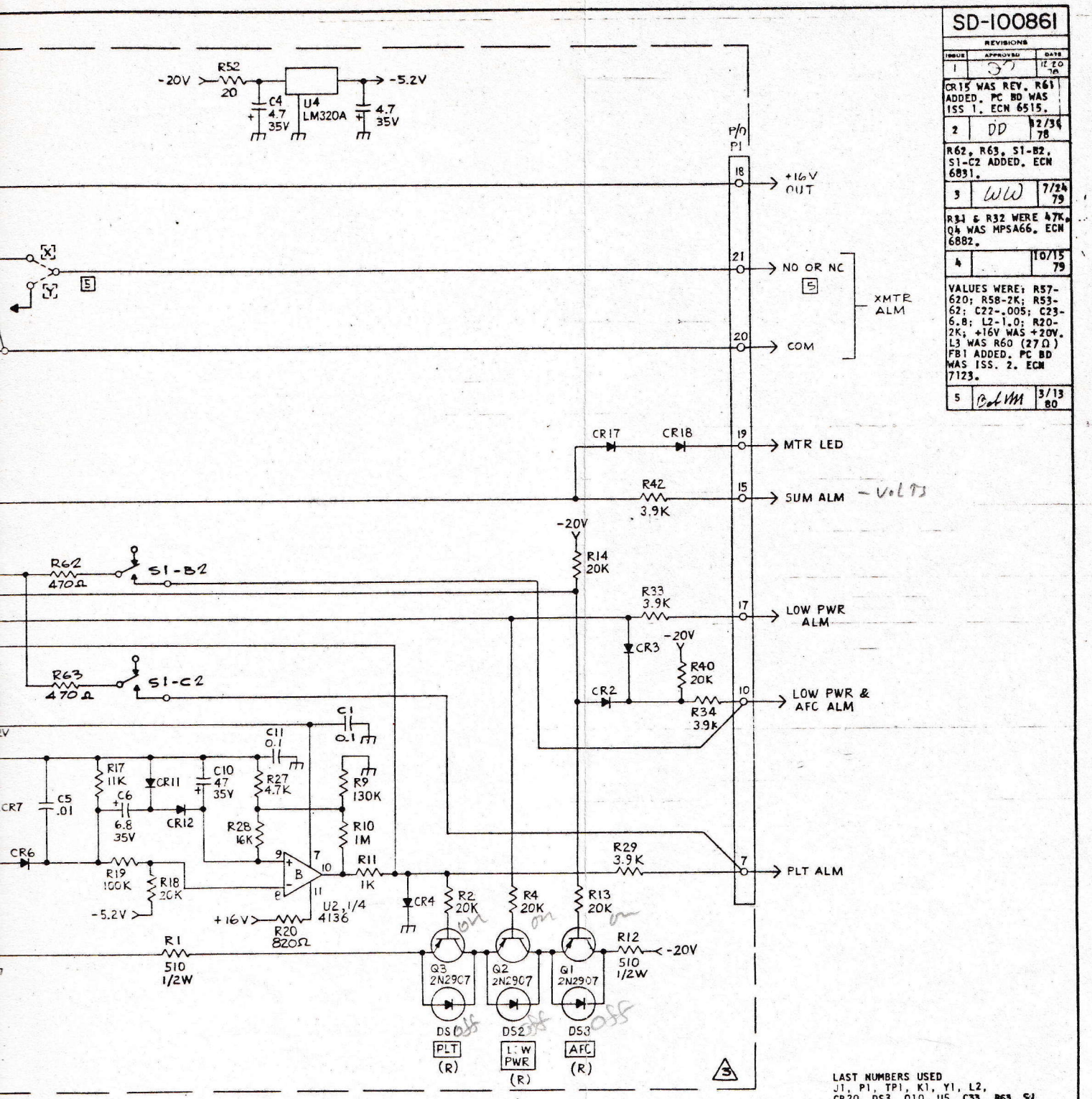
[3] EQUIPMENT OPTIONS ARE PER TABLE A.

2. COMPONENT TYPE NUMBERS AND VLAUES ARE THOSE NORMALLY PROVIDED. SUESTITUTUIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ±5%, 1/4W; 1% RESISTORS ARE 1/8W, AND CAPACITOR VALUES ARE IN MICROFARADS. DIODES ARE 1N4148.

NOTES:

SD-100861



SD-100861		
REVISIONS		
ISSUE	APPROVED	DATE
1	JJ	12 20 78
CR15 WAS REV. R61 ADDED. PC BD WAS ISS 1. ECN 6515.		
2	DD	02/30 79
R62, R63, S1-B2, S1-C2 ADDED. ECN 6831.		
3	WW	7/24 79
R31 & R32 WERE 47K. Q4 WAS MPSA66. ECN 6882.		
4		10/15 79
VALUES WERE: R57-620; R58-2K; R53-62; C22-.005; C23-6.8; L2-1.0; R20-2K; +16V WAS +20V. L3 WAS R60 (27Ω) FB1 ADDED. PC BD WAS ISS. 2. ECN 7123.		
5	Bob MM	3/13 80

LAST NUMBERS USED
J1, P1, TP1, K1, Y1, L2,
CR20, DS3, Q10, U5, C33, R63, S1

TABLE B [5]

OPTION	DESCRIPTION
X	ALARM RELAY CONTACTS NORMALLY CLOSED
Y	ALARM RELAY CONTACTS NORMALLY OPEN

SYM	DESCRIPTION
	DENOTES PRINTED BOARD MARKING.
	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
—○—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—●—	REFERS TO CIRCUIT JUNCTION POINT.

LEGEND

ISSUE NUMBER CROSS REFERENCE

SD	1	2	3	4	5	-				
TI	1	1	1	1	1A					

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA ± .005"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: FLI-2

SCALE NONE | ENGR BY JS | APP'VD
DATE 7-__-79 | DRAWN BY EJ | APP'VD

Farinon

XMTR ALM

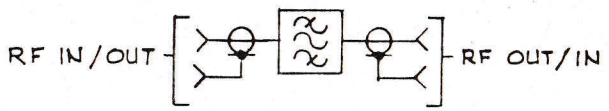
ORIG FE | SHEET | OF | SHEETS | DWG SIZE
DUPL

SD-100861 D

TABLE A [1]

OPTION	TUNING RANGE	SYSTEM USED ON
001	2.02-2.2 GHz	RL46
002	2.2-2.4 GHz	RL46
003	1.629-1.77 GHz	FL1-2
004	1.768-1.921 GHz	FL1-2
005	1.914-2.061 GHz	FL1-2
006	2.02-2.2 GHz	FL1-2
007	1.629-1.77 GHz	RL46
008	1.768-1.921 GHz	RL46

[1]



ELECTRICAL SPECIFICATIONS:

TUNING RANGE	SEE TABLE A
INSERTION LOSS	1.5 dB
B W 3 dB	30 MHz
IMPEDANCE	50Ω

[1] EQUIPMENT OPTIONS ARE PER TABLE A.

NOTE:

TI NOT REQUIRED

SD-101103		
REVISIONS		
ISSUE	APPROVED	DATE
1	Mita P.	9-18 78
-006 ADDED. ECN 6479.		
2		1/17 79
007 & 008 ADDED. ECN 6566.		
3	Mita P.	3/16 79

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64" | ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .002"

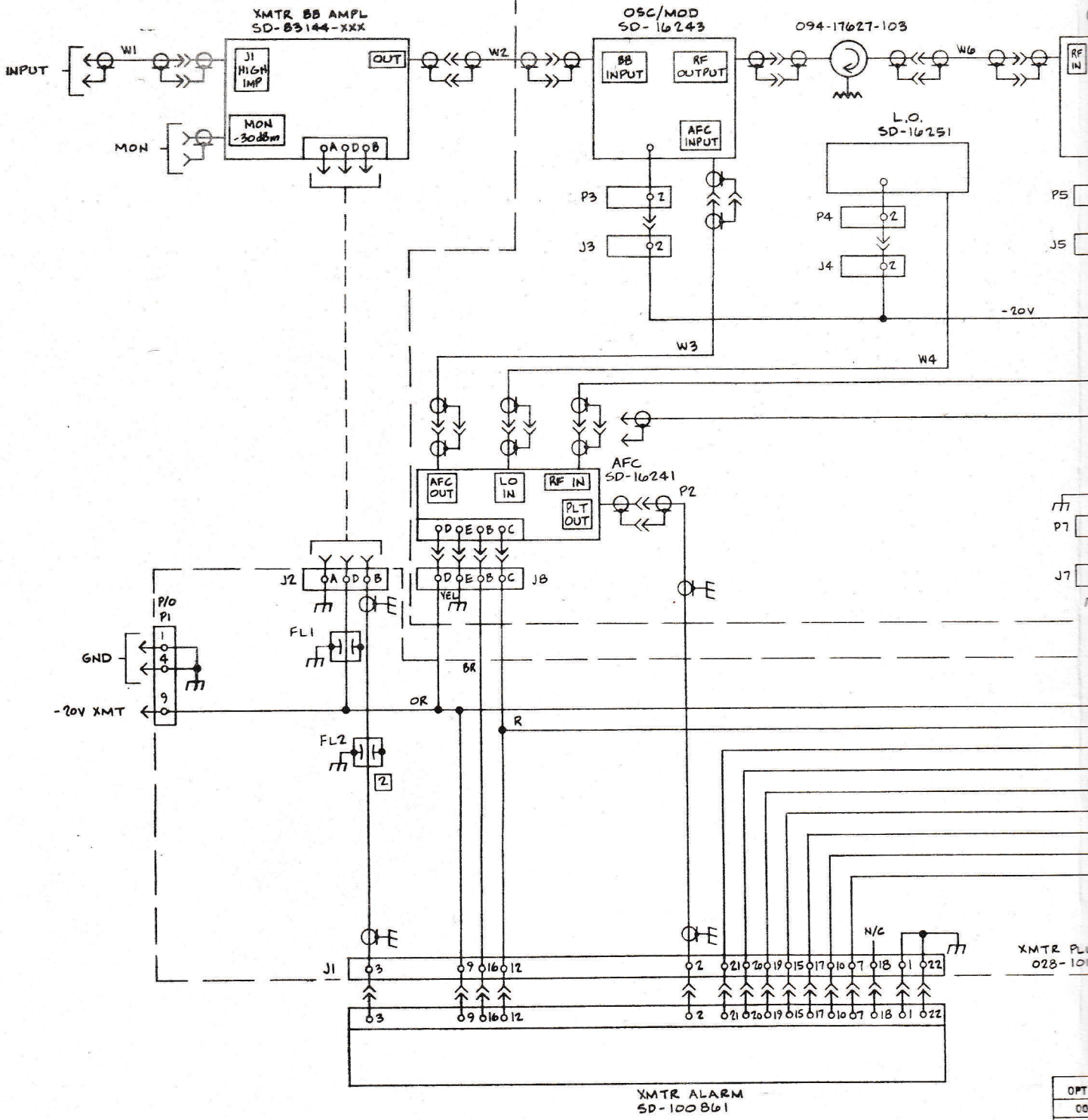
MATERIAL:
FINISH:
PROCESS:
USED ON: SEE TABLE A

SCALE ———	ENGR. BY MITA P.	APP'VD.
DATE 9-15-78	DRAWN BY MA	APP'VD.

Farinon

RF FILTER 2GHz

ORIG.		SHEET 1 OF 1 SHEETS	DWG. SIZE
DIST.	B		
SD-101103			B



OPT
00
00
00

[3] EQUIPMENT OPTIONS ARE PER TABLE A.

[2] FL2 IS LOW CAPACITY FEEDTHRU (LESS THAN 10 pF).

[1] CIRCULATOR & EXTERNAL 50Ω LOAD USED WITH COAX SWITCH PROTECTED SYSTEMS ONLY.

NOTES:

SD-101241

REVISIONS

ISSUE	APPROVED	DATE
1		12-20-78

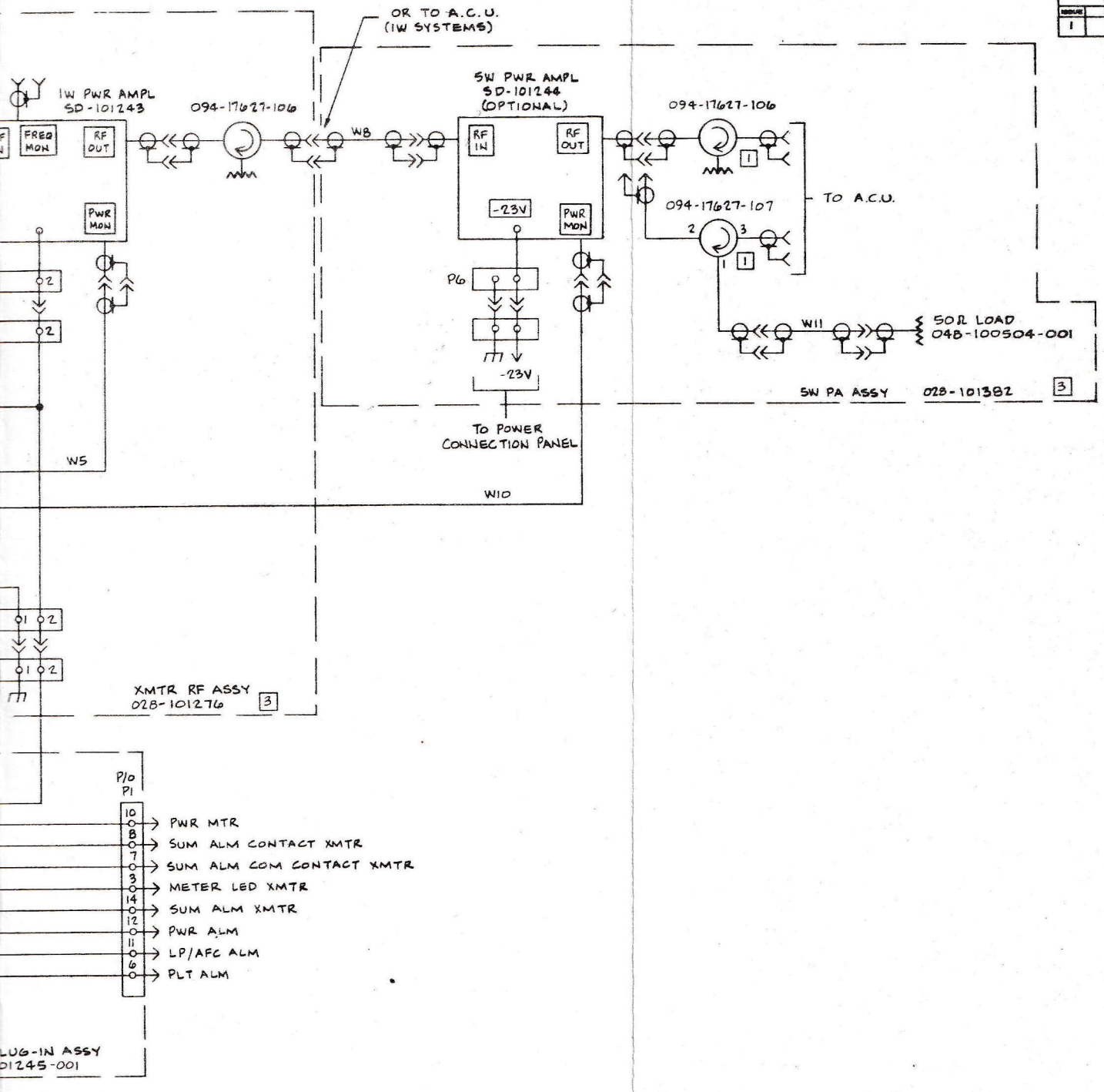


TABLE A 3

PTION	CONFIGURATION	XMTR R F ASS'Y	5 WATT PA ASS'Y
001	1 WATT PROT. OR N.P.	028-101276-001	-
002	5 WATT XMTR NON PROT. OR DIODE SW PROT.	028-101276-002	028-101382-001
003	5 WATT XMTR COAX SW. PROT.	028-101276-002	028-101382-002

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .018" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .008" | HOLES UNDER .250 DIA. ± .003"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON:

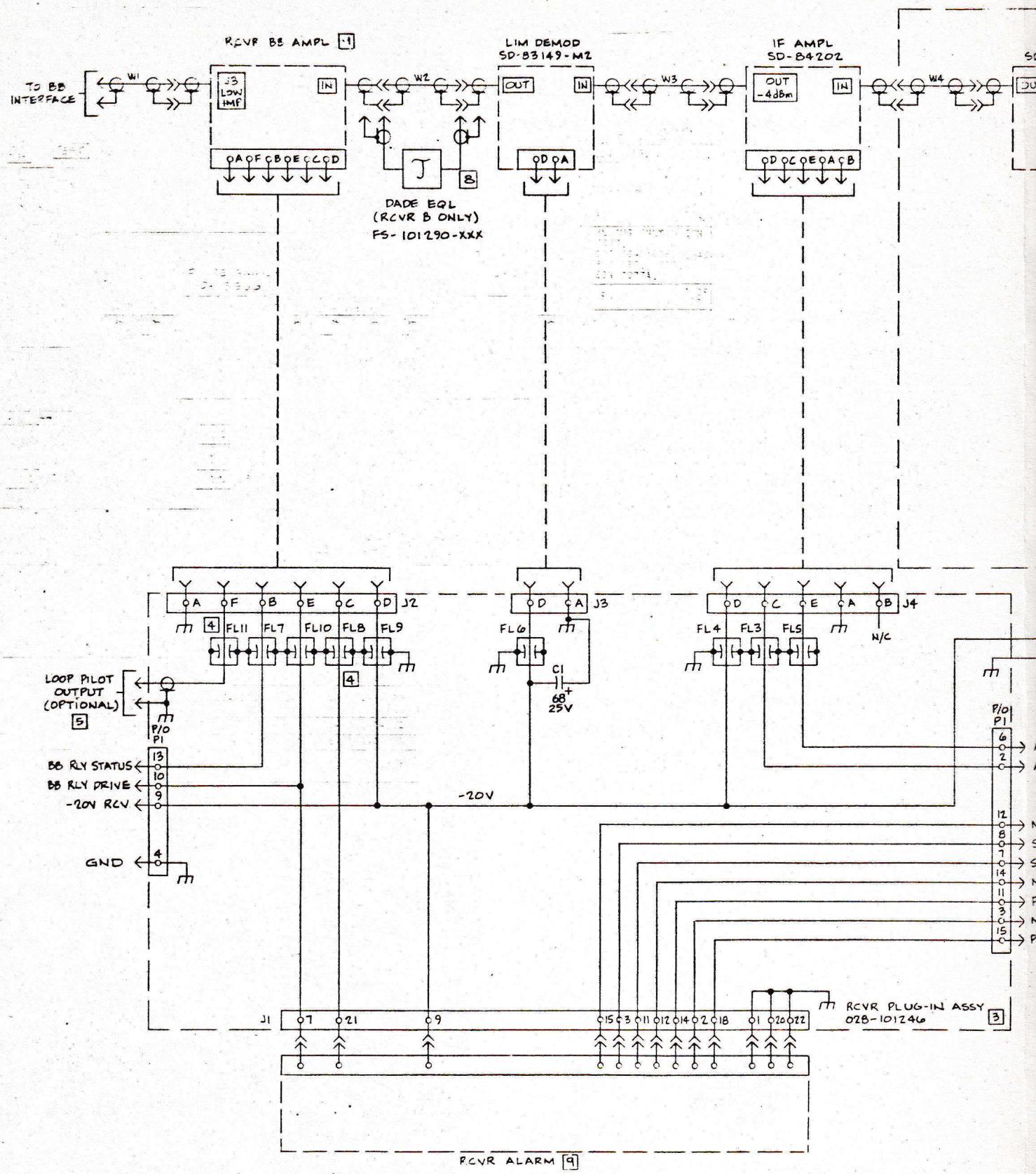
SCALE	ENGR. BY DD	APP'VD.
DATE 6-16-78	DRAWN BY MSH	APP'VD.

Farinon

XMTR ASSY

ORIG.		SHEET 1 OF 1 SHEETS	SIZE
REV.	K		

SD-101241 D



2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ±5%, 1/4W; 1% RESISTORS ARE 1/8W, AND CAPACITOR VALUES ARE IN MICROFARADS.

NOTES:

6 REFERS TO LOOP SYSTEMS USING SD-83226 BASEBAND INTERFACE & LOOP SWITCH.

5 LOOP PILOT OUTPUT IS EQUIPPED ONLY FOR OPTION -002 OF RCVR PLUG-IN ASSEMBLY.

4 LOW CAPACITY FEED-THRU (LESS THAN 10pf).

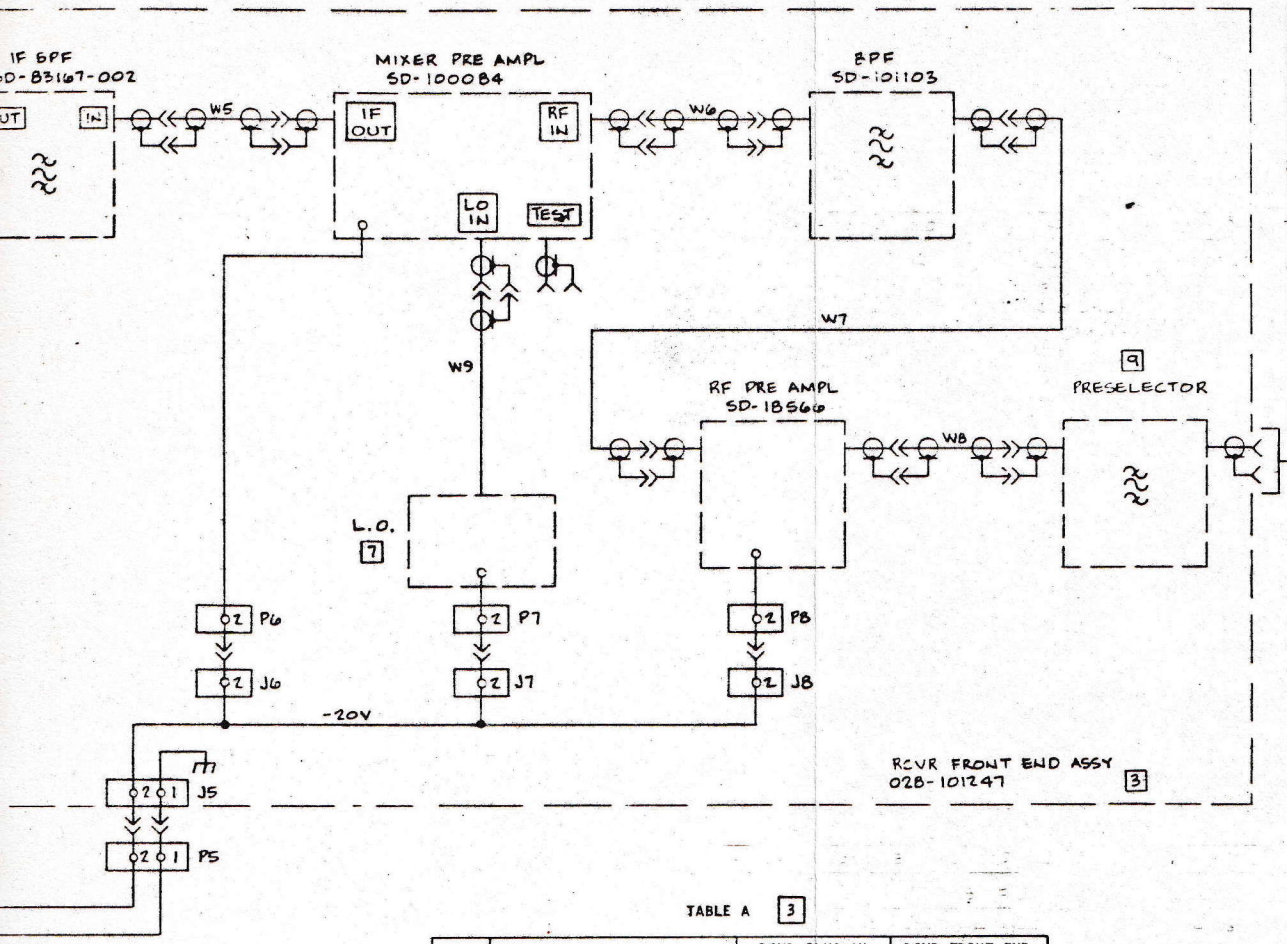
3 EQUIPMENT OPTIONS ARE PER TABLE A.

9 UNIT SCHEMATIC NUMBERS LISTED

8 FOR SPACE DIVERSITY PROT. SYST IS REPLACED BY DIFFERENTIAL AB FS-101290-XXX AND CABLES 087-8 OPTION INFORMATION TO BE SUPPL

7 L.O. IS EQUIPPED PER TABLE B.

SD-101242



SD-101242

REVISIONS

ISSUE	APPROVED	DATE
1		

PL CHANGE ONLY. ECN 6734.

2		6/5 79

FREQ. DIV. ADDED TO OPT. 001. TABLE C ADDED. (WAS P/O TABLE A). NARROW BW PRESELECT ADDED. ECN 6899.

3		9/26 79

C1 ADDED. ECN 7014.

4		12/11 79

PL CHG ONLY. ECN 7077. OPT. 004 ADDED. (WAS P/O OPT. 001). ECN 7077A.

5		2/25 80

AGC OUTPUT
AGC METER

NODAN ALM OUTPUT
SUM ALM COM CONTACT RCVR
SUM ALM CONTACT RCVR
NOISE LEVEL
PLT ALM OUTPUT
METER LED RCVR
PLT/NOD ALM

TABLE A [3]

OPT	SYSTEM TYPE	RCVR PLUG-IN ASSEMBLY	RCVR FRONT-END ASSEMBLY
001	NON PROTECTED	028-101246-001	028-101247-001
002	COMMON ANTENNA PROTECTED	028-101246-001	028-101247-002
003	LOOP SYSTEMS [6]	028-101246-002	028-101247-001
004	FREQ. DIV. PROTECTED OR SPACE DIV. PROTECTED	028-101246-001	028-101247-003

TABLE B [7]

FREQ RANGE	L.O. TYPE
1.7 - 2.0GHz	SD-16251-001

TABLE C [9]

SYSTEM TYPE	RCVR BB AMPL	RCVR ALARM	PRESELECTOR STD B.W.	PRESELECTOR NARROW B.W.
NON-PROTECTED/ LOOP-PROTECTED	SD-83146	SD-84036	SD-16588	—
COMMON ANTENNA PROTECTED	SD-83147	SD-83150	NOT EQP'D	—
SPACE DIVERSITY PROTECTED	SD-83147	SD-83150	SD-16588	—
SPACE DIV. PROT/ FREQ. DIV.	SD-83147	SD-83150	—	SD-101488

IN TABLE C.

TEMS ONLY: W2 ON RCVR B
BSOLUTE DELAY EQUALIZER,
83605-418 & 087-83605-422.
PLIED BY SYSTEMS ENGINEERING.

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .01" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64" | ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .002"

MATERIAL:
FINISH:
PROCESS:
USED ON FLI-2

SCALE —— | ENGR BY DD | APP'D
DATE 7-14-78 | DRAWN BY MSH | APP'D

Farinon

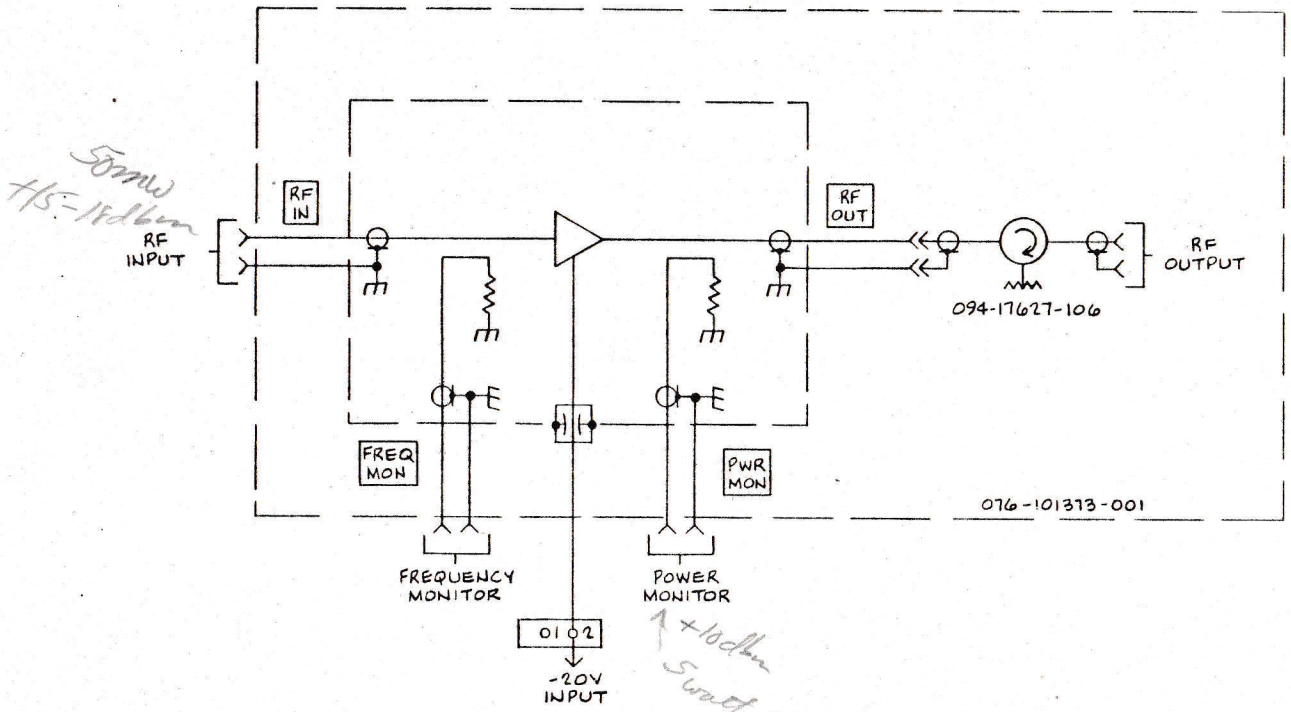
RCVR ASSY

ORIG. | SHEET 1 OF 1 SHEETS | DWG SIZE
DIST.

SD-101242 D

-101243

REVISIONS		
ISSUE	APPROVED	DATE
1		



SPECIFICATIONS:

FREQUENCY RANGE:	1850-1990 MHz	
INPUT/OUTPUT IMPEDANCE:	50Ω, UNBAL	
INPUT LEVEL:	+15 TO +18 dBm	
OUTPUT LEVEL:	+30.5 dBm MINIMUM	+33.5 dBm MAXIMUM
GAIN FLATNESS:	0.25 dB/MHz	
CONNECTORS:	RF SMA	
	POWER FEED-THRU	
POWER REQUIREMENT:	-20V DC AT 400 mA, MAXIMUM	

TI NOT REQUIRED

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE: 2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1° 3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA ± .005" FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON FLI-2

SCALE —	ENGR BY DD	APP'D
DATE 6-15-78	DRAWN BY MSH	APP'D

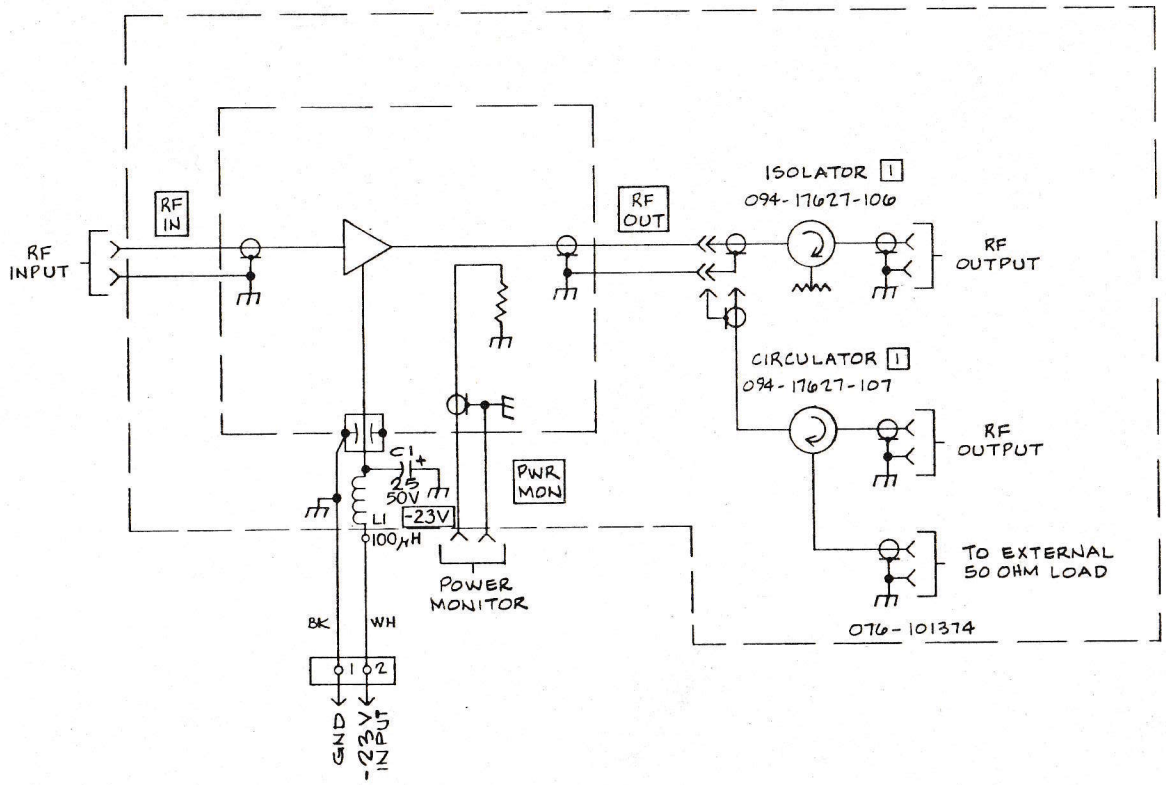
Farinon

1 WATT PWR AMPL

ORIG		SHEET 1 OF 1 SHEETS	DWG SIZE
DIST.	R		
SD-101243			C

SD-101244

REVISIONS		
ISSUE	APPROVED	DATE
1	[illegible]	5/21/79
C1 ADDED, CABLE GROUND LEAD ADDED. ECN 6678.		
2	WW	6/6/79
L1 ADDED. ECN 7069.		
3	K	2/21/80



T1 NOT REQUIRED

SPECIFICATIONS

FREQUENCY RANGE:	1850 - 1990 MHz
INPUT/OUTPUT IMPEDANCE:	50Ω, UNBAL.
INPUT LEVEL:	+30 dBm NOMINAL
OUTPUT LEVEL:	+37.5 dBm MINIMUM; +39.5 dBm MAXIMUM
GAIN FLATNESS:	0.25 dB/MHz
CONNECTORS: RF	SMA
POWER	FEED THROUGH
POWER REQUIREMENT:	-23V DC AT 1.5A, MAX.

TABLE A [1]

OPTION	DESCRIPTION	EQUIPMENT
001	NON-PROT XMTRS & PROT WITH DIODE SW	ISOLATOR
002	PROTECTED XMTRS WITH COAX SW	CIRCULATOR

[1] EQUIPMENT OPTIONS ARE PER TABLE A.

NOTE:

SD-101244

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: FLI-2

SCALE —— | ENGR. BY DD | APP'VD.
DATE 6-15-78 | DRAWN BY MSH | APP'VD.

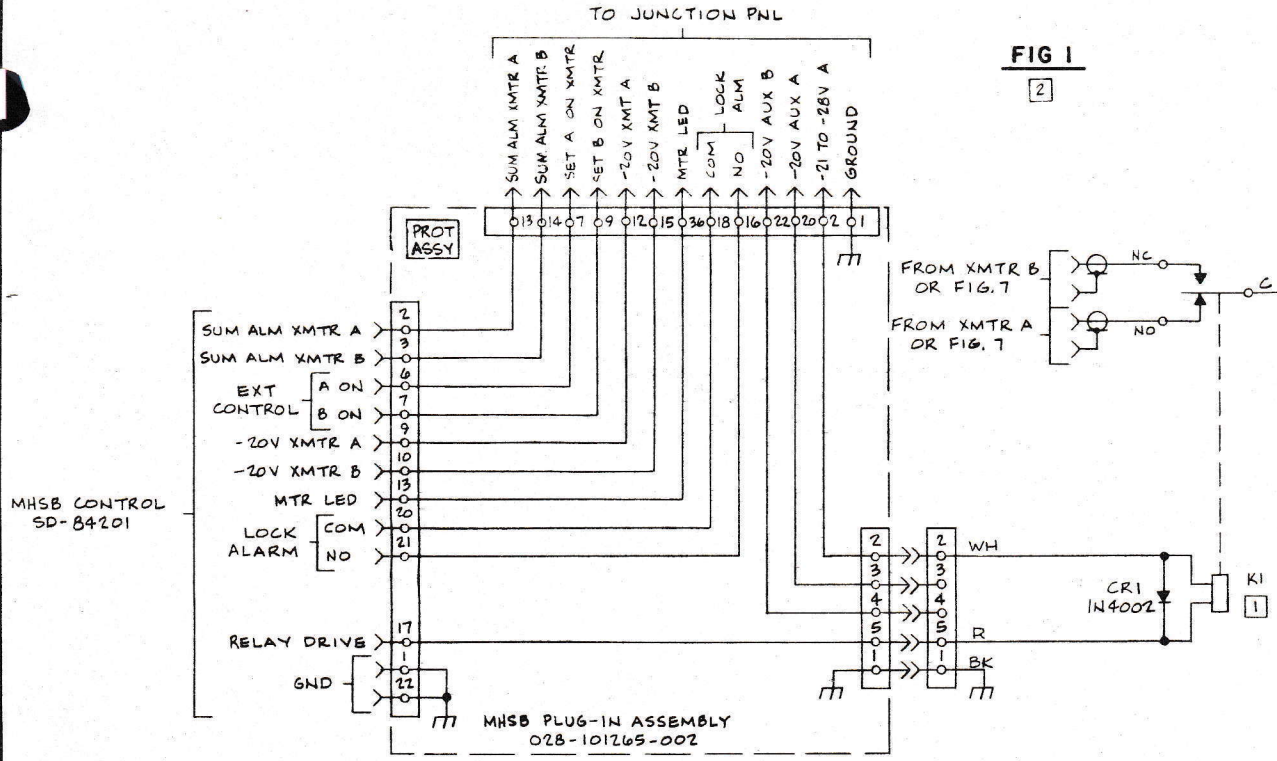
Farinon

5WATT PWR AMPL

ORIG. | SHEET 1 OF 1 SHEETS | DWG. SIZE
DIST. R
SD-101244 C

FIG 1

[2]

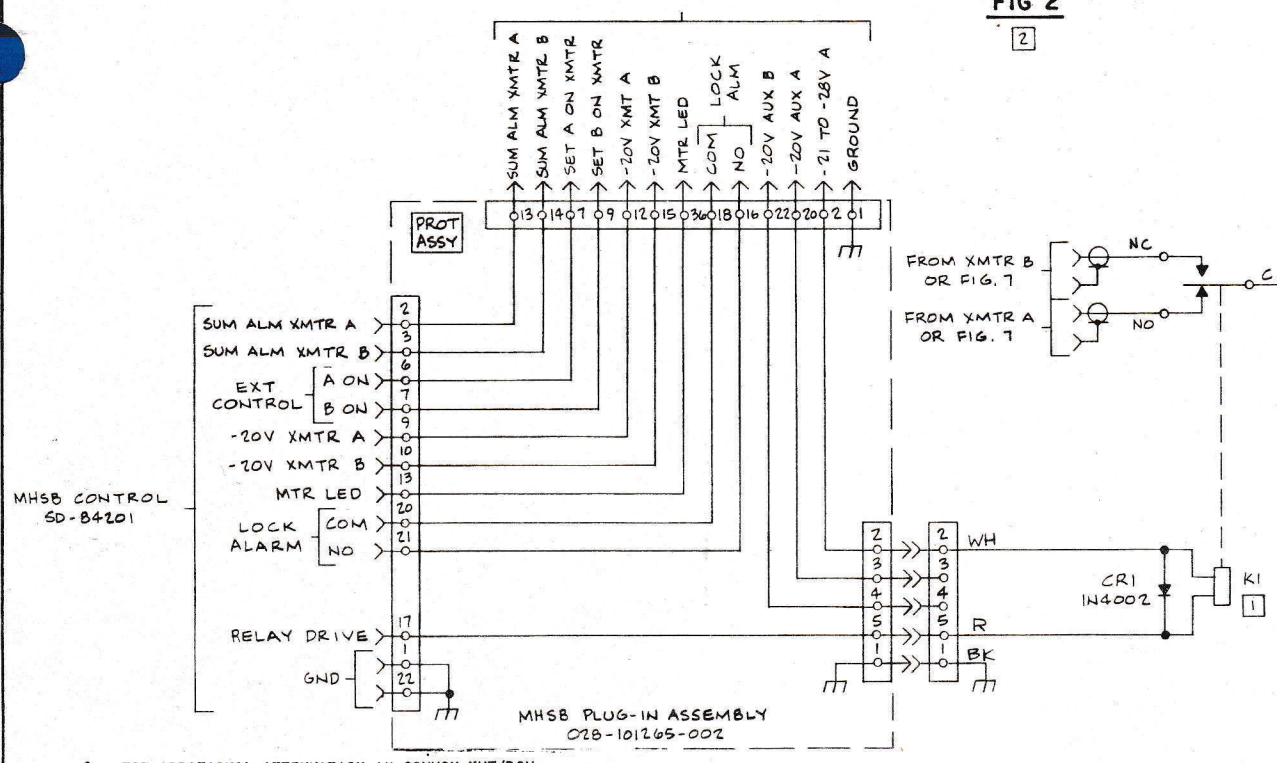


TRANSMIT BRANCH I
RECEIVE BRANCH IN

SHARED PRESELECTOR	STANDARD BANDWIDTH	NARROW BANDWIDTH	SEPARATE PRESELECTOR
X	X		
X		X	
X	X		
X		X	
			X

FIG 2

[2]



DIGIT	CONFIGURATI
1XX	SHARED PRESELE STANDARD BW
2XX	SHARED PRESELE NARROW BW
3XX	SEPARATE PRE-SELECTORS
4XX	SPACE DIVERSIT

3. FOR ADDITIONAL ATTENUATION IN COMMON XMT/RCV PATH, PAD(S) MAY BE CONNECTED TO THE ANTENNA PORT(S). RECOMMENDED PAD NARDA TYPE 766.

[2] EQUIPMENT OPTION NUMBERS CONSIST OF DIGITS SELECTED FROM TABLES A, B & C AS FOLLOWS:

X X X
- 3RD DIGIT ANT PORT VSWR/BAND FROM TABLE C.
- 2ND DIGIT ATTENUATOR VALUE FROM TABLE B.
- 1ST DIGIT BASIC CONFIGURATION FROM TABLE A.

[1] K1 NORMALLY ENERGIZED. ('A' BATTERY BUS).

NOTES:

[9] FOR OPTIONS 1X0 OR 2X0, W4 IS 087-018938-163 AND W5 IS 087-018938-164. FOR OPTIONS 1X1 OR 2X1, W4 IS 087-018938-175 AND W5 IS 087-018938-172.

[8] FOR OPTION 3X0 W3 IS 087-018938-148. FOR OPTION 3X1 W3 IS 087-018938-177.

[7] TECHNICAL SUMMARY SHOWN IN TABLE D.

[6] STANDARD ANT. PORT VSWR, 1.22:1. LOW ANT. PORT VSWR, 1.1:1.

[5] FIG. 5 MAY BE SD-16247 RF HYBRID OR SD-18304 10 dB COUPLER.

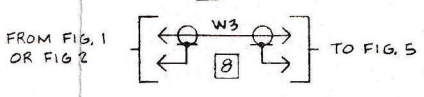
[4] NARDA TYPE 4774 PAD.

SD-101254

SD-101254		
REVISIONS		
ISSUE	APPROVED	DATE
1	[illegible]	5-23-79
TABLE A: OPT 2XX FL2 WAS SD-60456; "SPECIAL INTERFERENCE" ADDED TO 4XX. ECN 6899.		
2	[illegible]	9/27 79
FIG 1&2: WIRE COLORS TO K1 WERE REVERSED ECN 6930. CABLE NOS. & NOTES 8&9 ADDED. ECN 6954		
3	[illegible]	11-7 79
FIG 6 ISOLATOR ADDED. ECN 7138.		
4	WW	3-25 80

FIG 3

[2]



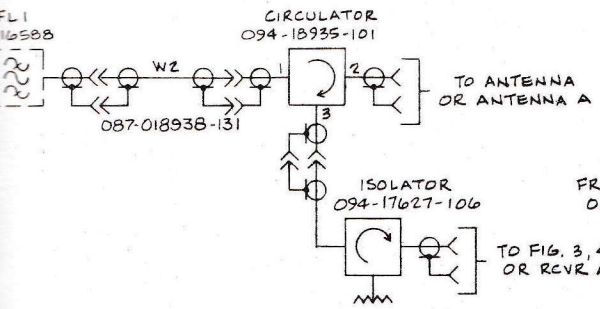


FIG 4

[2]

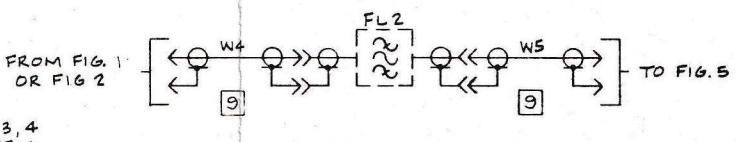


TABLE D [7]

INSERTION LOSS: 1.0 dB + RF ATTENUATOR VALUE

INSERTION LOSS:

RF HYBRID	10 dB COUPLER	SPACE DIVERSITY	RECEIVER A	RECEIVER B
X			5 dB	5 dB
X			6 dB	6 dB
	X		2,5 dB	12,5 dB
	X		3,5 dB	13,5 dB
			4,5 dB	4,5 dB
		X	1 dB	0 dB

FIG 5

[2] [5]

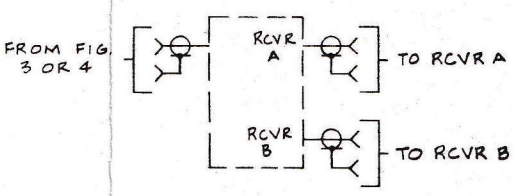
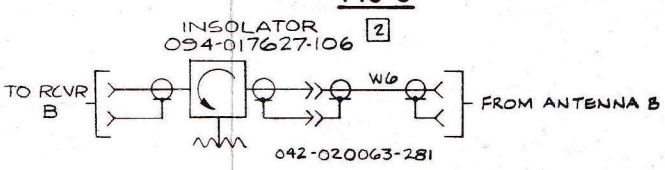


FIG 6

[2]



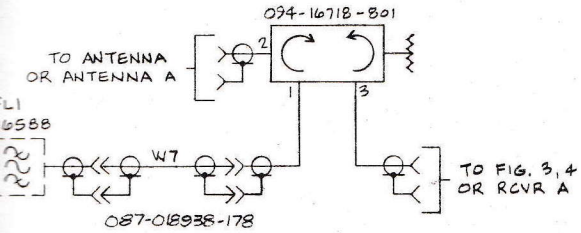


FIG 7

RF ATTENUATOR [4]

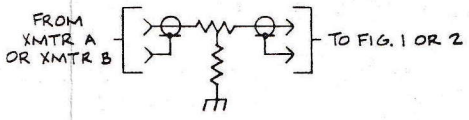


TABLE A [2]

ATION	APPLICATION	FL2	FIGURES EQUIPPED
LECTOR,	NORMAL	SD-16588	4,5
LECTOR,	SPECIAL INTERFERENCE REQUIREMENTS	SD-101480	4,5
-	SPECIAL FREQ. ASSIGNMENTS	-	3,5
ITY	NORMAL OR SPECIAL INTERFERENCE	-	6

TABLE B [2]

DIGIT	PAD VALUE	APPLICATION	FIGURE EQUIPPED
XOX	0 - NOT EQUIPPED	NORMAL	
X1X	3dB	SPECIAL-REDUCE EMITTED POWER	7
X2X	6dB	SPECIAL-REDUCE EMITTED POWER	7
X3X	10dB	SPECIAL-REDUCE EMITTED POWER	7

TI NOT REQUIRED

TABLE C [2] [8]

DIGIT	FREQ BAND	APPLICATION	VSWR	CIRCULATOR/ISOLATOR	FIGURE EQUIPPED
XX0	1850-1990MHz	NORMAL	STANDARD	094-18935-101/ 094-17627-106	1
XX1	1850-1990MHz	SPECIAL	LOW	094-16718-801	2

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .010" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: FL1-2

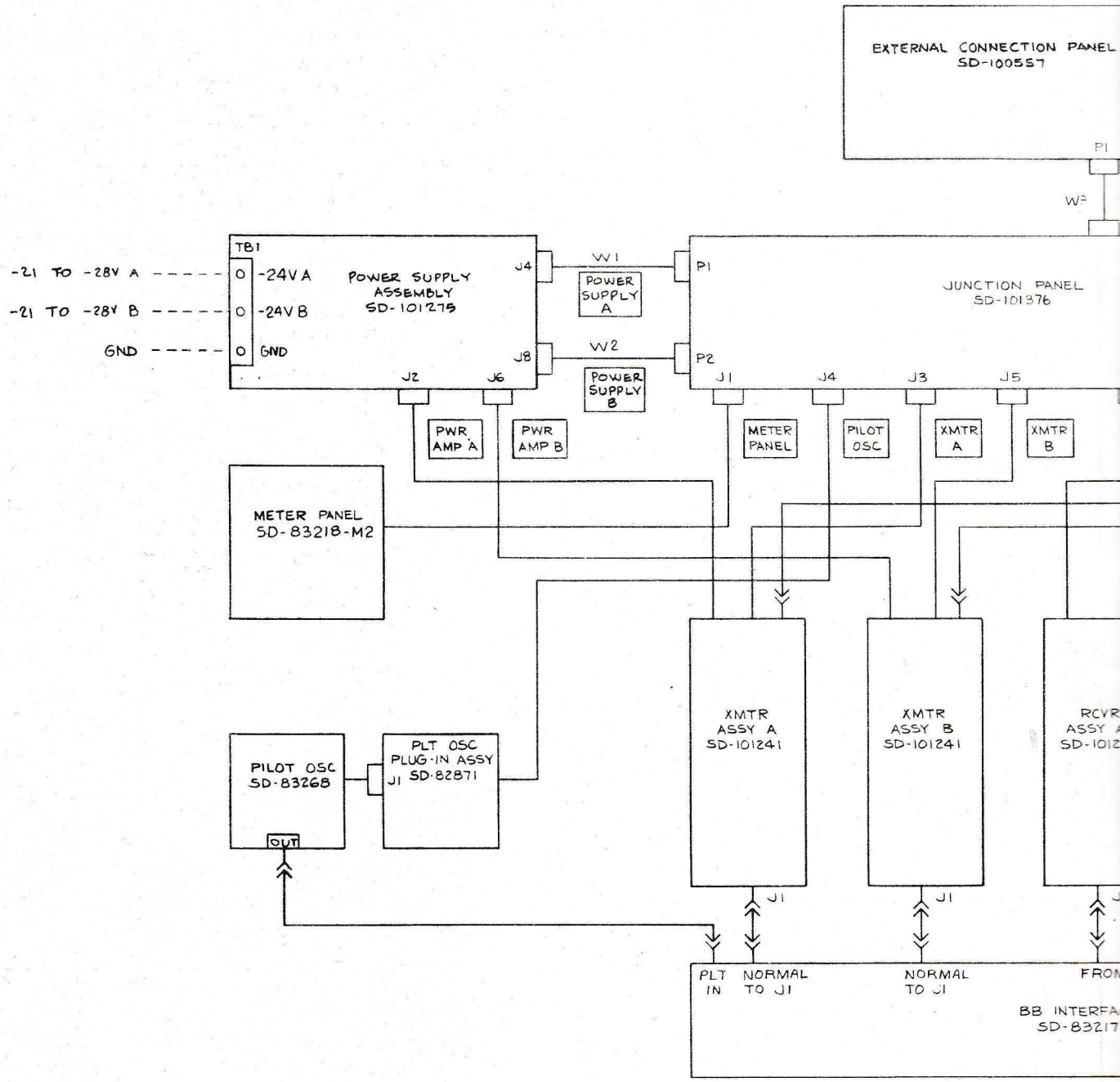
SCALE ———	ENGR. BY DD	APP'VD.
DATE 8-10-78	DRAWN BY MSH	APP'VD.

Farinon

ANTENNA COUPLING UNIT (MHSB COAX SWITCH)

ORIG.	SHEET 1 OF 1 SHEETS	DWG SIZE
DIST. R		

SD-101254 D



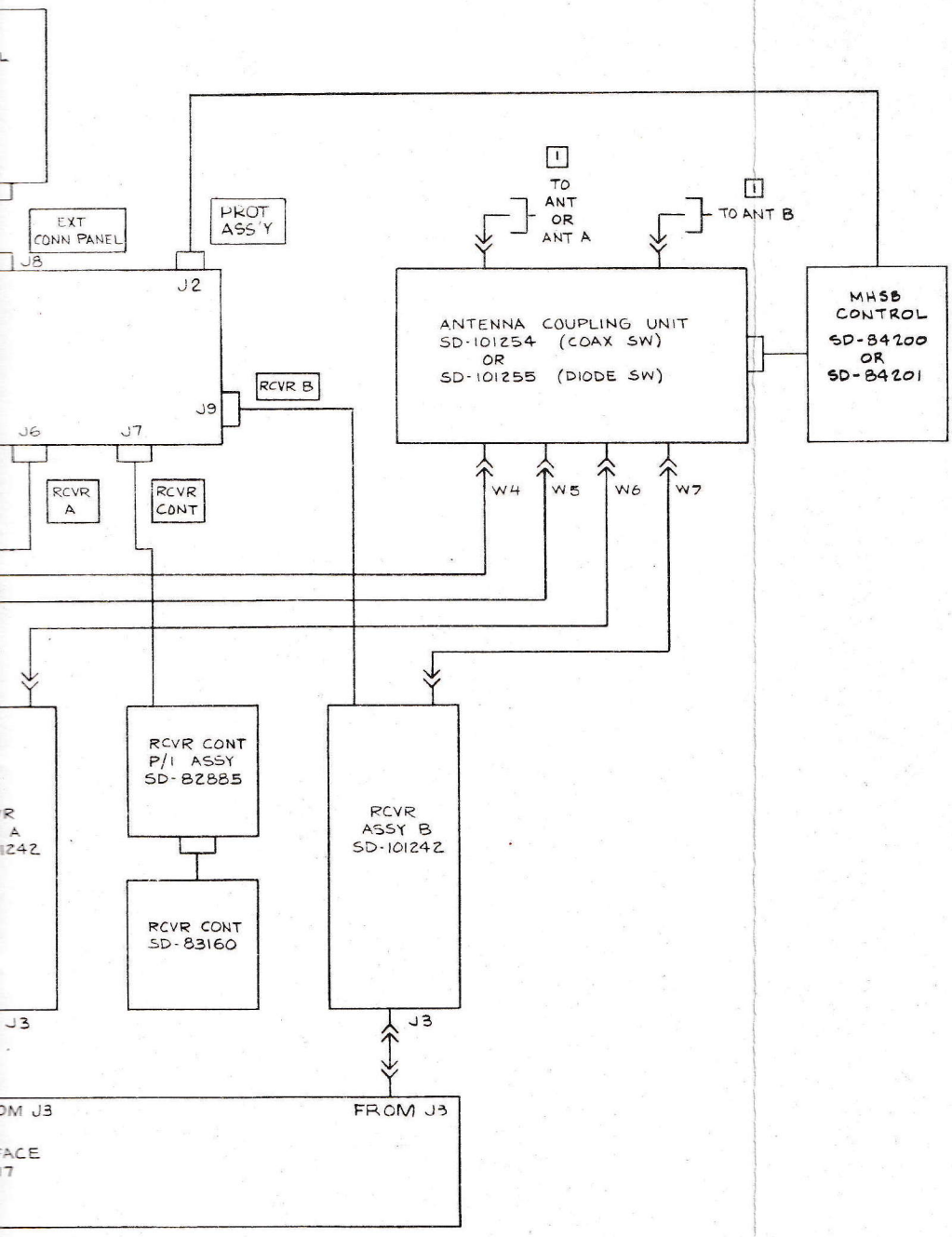
3 FOR B WIRED ONLY OPTION,, DELETE B XMTR & RCVR ASSEMBLIES, RCVR CONTROL AND MHSB CONTROL PLUG-INS.

2 EQUIPMENT OPTIONS ARE PER TABLE A.

1 TWO ANTENNAS (A & B) USED ONLY FOR SPACE DIVERSITY.

NOTES:

SD-101270		
REVISIONS		
ISSUE	APPROVED	DATE
1	99	12-20 78
OPT. 006 XMTR PWR WAS 1 OR 5 WATT. ECN 6638.		
A	99	4/18 79



[2] TABLE A

OPTION	XMTR POWER	ACU	RF ATTENUATOR	APPLICATION
001	1 WATT	EITHER	WITH OR WITHOUT	STANDARD
002	5 WATT	SD-101254	NOT EQUIPPED	STANDARD
003	5 WATT	SD-101254	EQUIPPED	SPECIAL
004	5 WATT	SD-101255	NOT EQUIPPED	STANDARD
005	5 WATT	SD-101255	EQUIPPED	SPECIAL
006	1 WATT	EITHER	WITH OR WITHOUT	B WIRE ONLY [3]

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64"
ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA. ± .002"

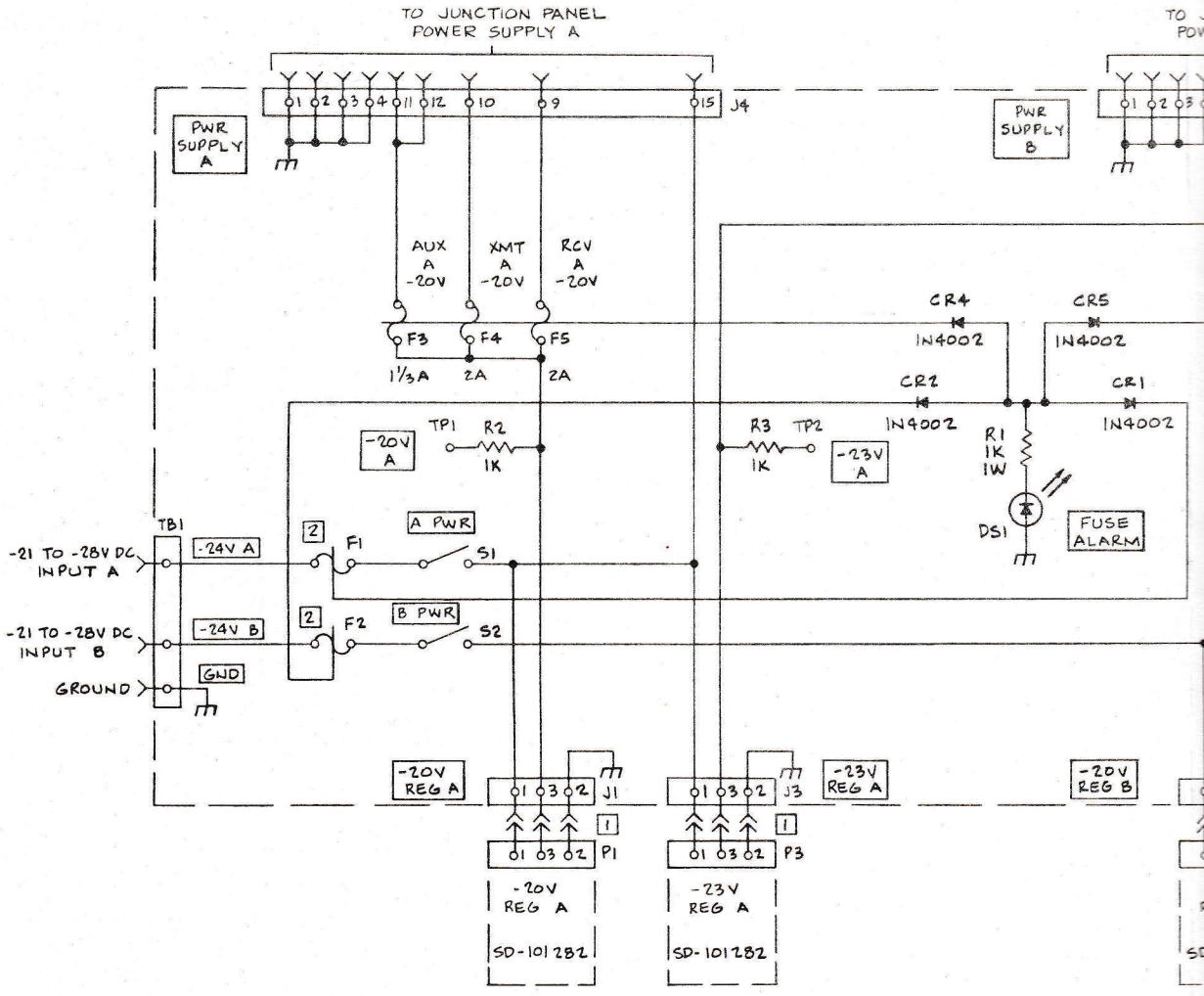
MATERIAL:
FINISH:
PROCESS:
USED ON: FLI-2

SCALE —	ENGR. BY DD	APP'VD.
DATE 9-6-78	DRAWN BY VJ	APP'VD.

Farinon

FLI-2 MHSB
RADIO ASSEMBLY

ORIG.		SHEET | OF | SHEETS	DWG. SIZE
DIST.	R		
SD-101270			D



2 EQUIPMENT OPTIONS ARE PER TABLE B.

1 EQUIPPED REGULATORS ARE PER TABLE A.

NOTE:

SD-101275

REVISIONS		
ISSUE	APPROVED	DATE
1	DD	12-20-78

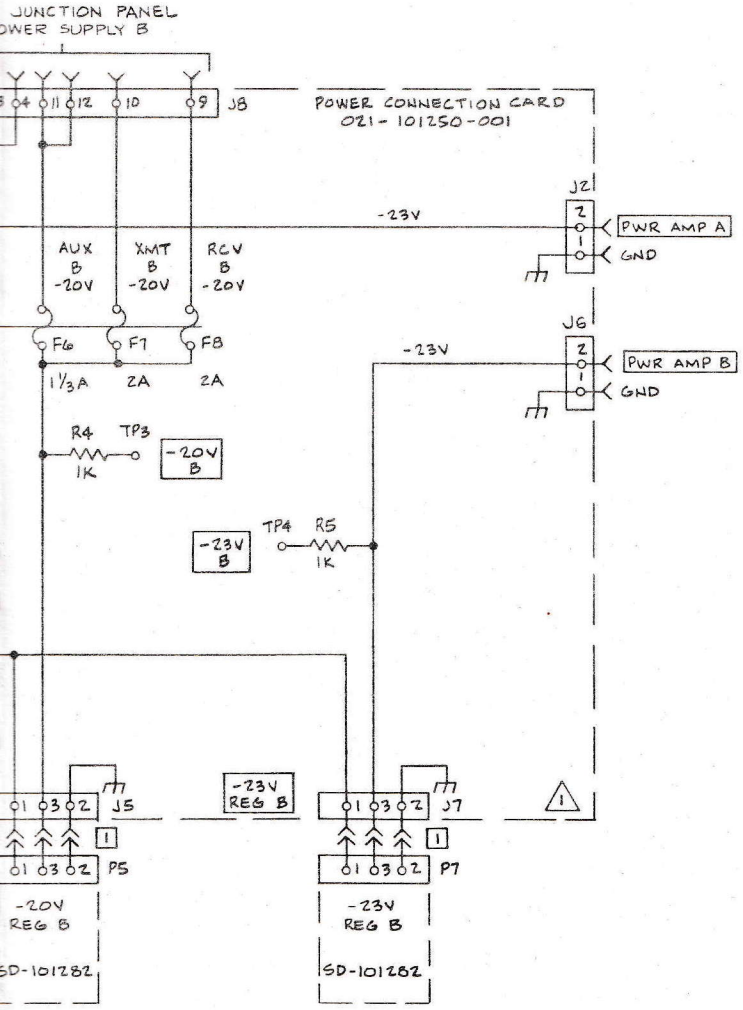


TABLE A [1]

APPLICATION	SD-101282 REGULATORS EQUIPPED
N.P. TERMINAL (1W)	-20V(A)
N.P. TERMINAL (5W)	-20V(A), -23V(A)
PROT TERMINAL (1W)	-20V(A), -20V(B)
N.P. REPEATER (5W)	-20V(A), -23V(A)
PROT TERMINAL (5W)	-20V(B), -23V(B)

TABLE B [2]

OPTION	XMTR POWER	F1, F2
001	1 WATT	3 AMP
002	5 WATT	5 AMP

ISSUE NUMBER CROSS REFERENCE

SD	1
TI	1

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .018" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .008" | HOLES UNDER .250 DIA. ± .003"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: FL1-2

SCALE ——	ENGR. BY DD	APP'VD.
DATE 8-7-78	DRAWN BY MSH	APP'VD.

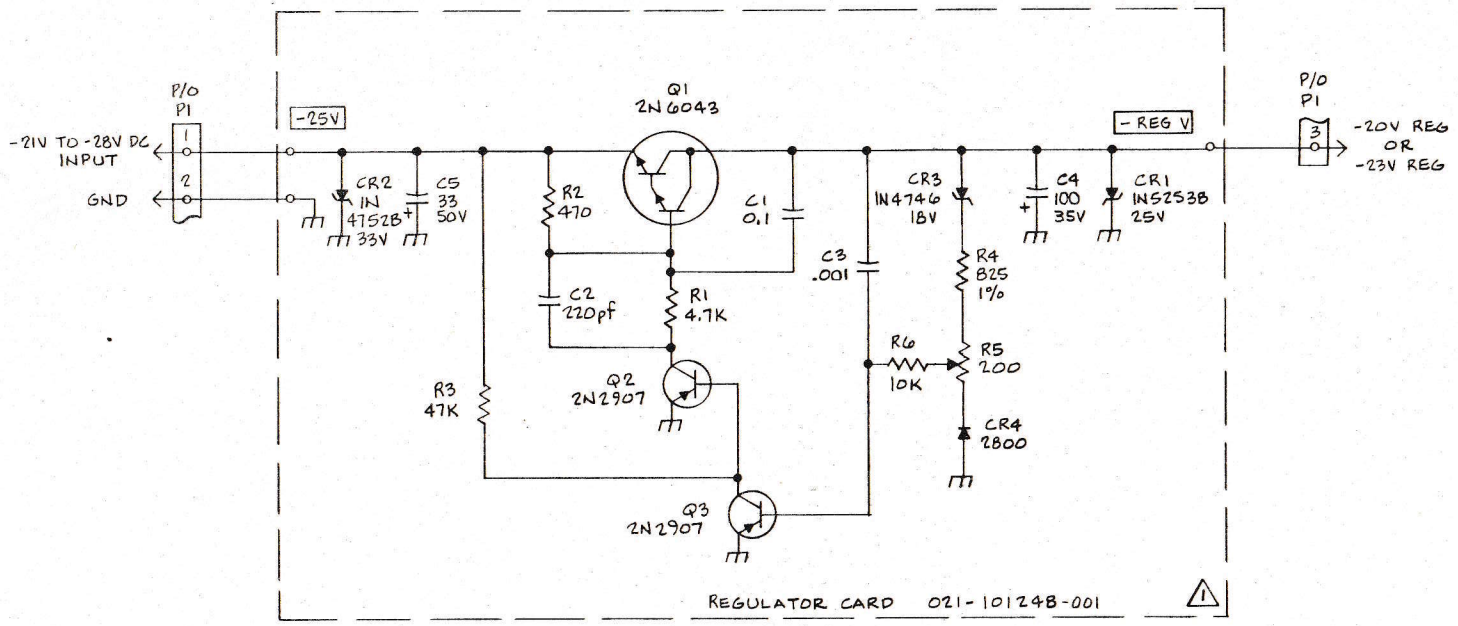
Farinon

POWER SUPPLY ASSEMBLY

ORIG. DIST. R	SHEET 1 OF 1 SHEETS	DWG. SIZE
SD-101275		D

REVISIONS

ISSUE	APPROVED	DATE
1	DD	2/20/78
C3 WAS 0.1. ECN 6718.		
2	Bob M	5/22/79
C4 WAS 33, 50V. ECN 6924.		
3	Bob M	10/15/79



LAST NUMBERS USED:
R6, C5, CR4, Q3

ISSUE NUMBER CROSS REFERENCE

SD	1	2	3	
TI	1	1	1	

SYM	DESCRIPTION
	DENOTES PRINTED BOARD MARKING.
	DENOTES NOTES OR FACEPLATE MARKINGS.
△	DENOTES PRINTED CIRCUIT BOARD ISSUE NUMBER.
	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
	REFERS TO CIRCUIT JUNCTION POINT.

LEGEND

3. THIS UNIT IS OPTION -001.

2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OF DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ±5%, 1/4W; 1% RESISTORS ARE 1/8W, AND CAPACITOR VALUES ARE IN MICROFARADS.

NOTES:

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
X PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA. ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL:
FINISH:
PROCESS:
USED ON: FLI-2

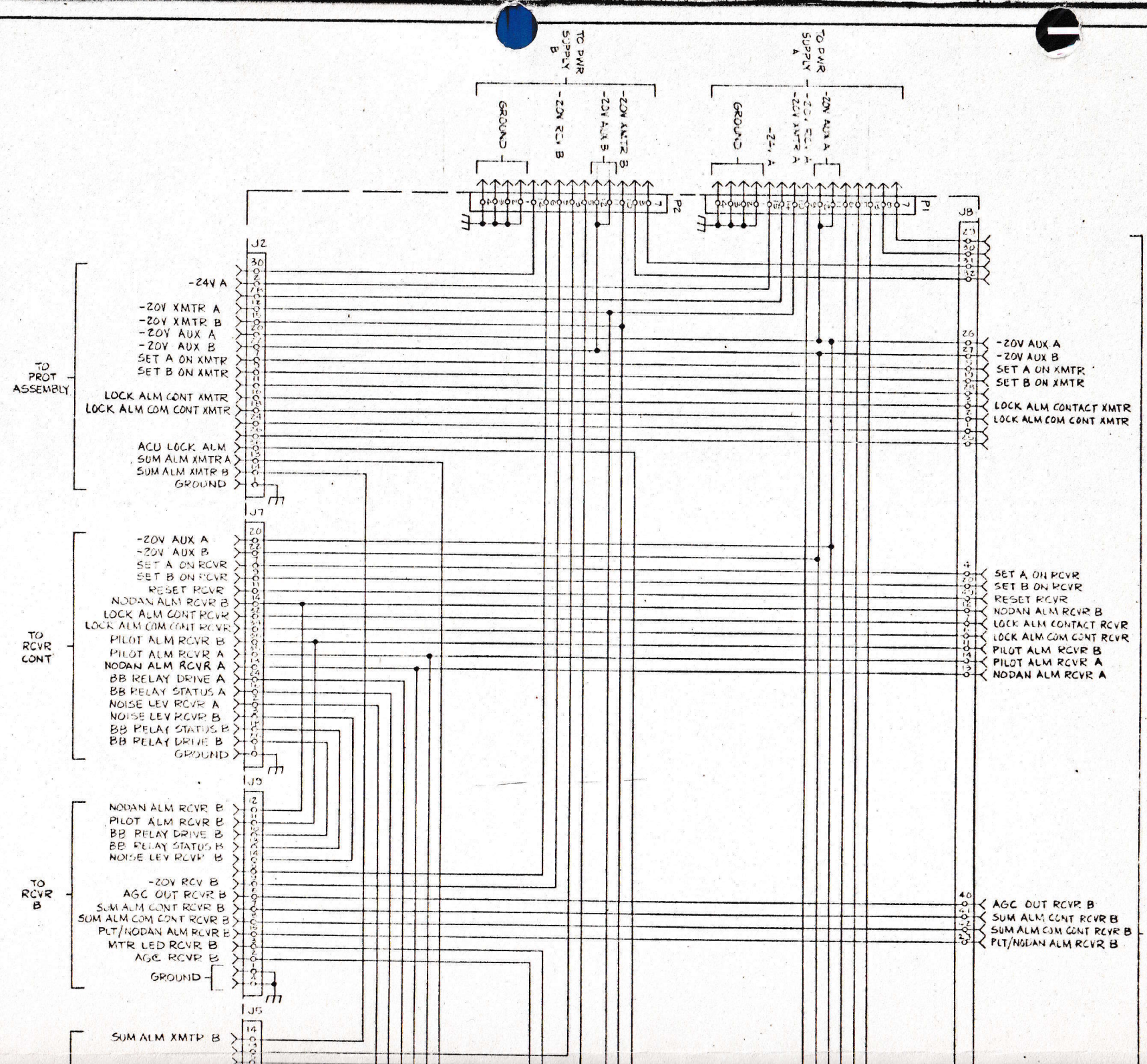
SCALE —— | ENGR. BY DD | APP'VD.
DATE 8-7-78 | DRAWN BY MSH | APP'VD.

Farinon

REGULATOR

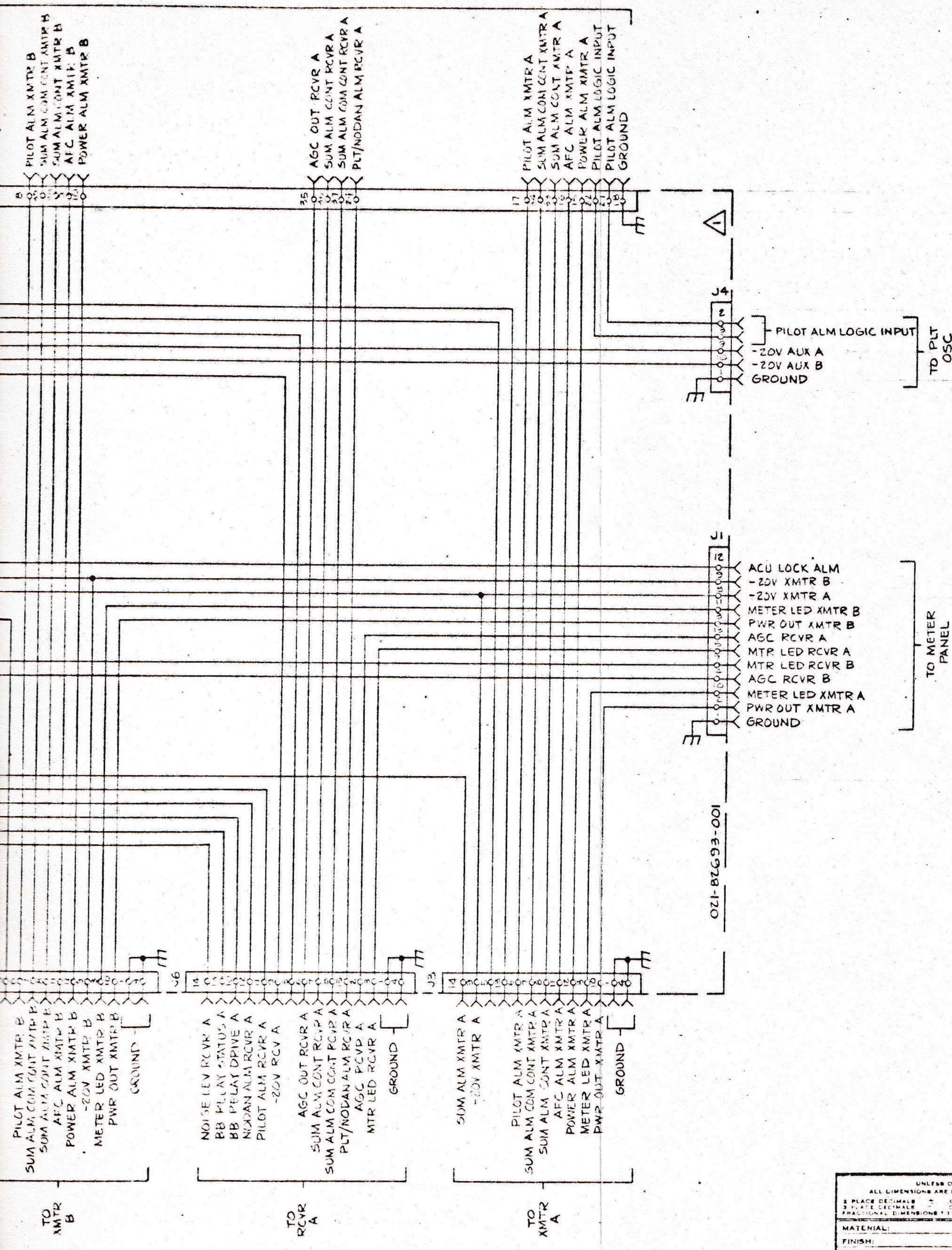
ORIG.
DIST.
SHEET | OF | SHEETS
DWG. SIZE

SD-101282 C


TO PWR SUPPLY B
GROUND
-20V RCV B
-20V AUX B
-20V XMTR B
TO PWR SUPPLY A
GROUND
-20V RCV A
-20V XMTR A
-20V AUX A
P2
P1
J8
J2
-24V A
-20V XMTR A
-20V XMTR B
-20V AUX A
-20V AUX B
SET A ON XMTR
SET B ON XMTR
LOCK ALM CONT XMTR
LOCK ALM COM CONT XMTR
ACU LOCK ALM
SUM ALM XMTR A
SUM ALM XMTR B
GROUND
TO PROT ASSEMBLY
-20V AUX A
-20V AUX B
SET A ON XMTR
SET B ON XMTR
LOCK ALM CONTACT XMTR
LOCK ALM COM CONT XMTR
J7
-20V AUX A
-20V AUX B
SET A ON RCVR
SET B ON RCVR
RESET RCVR
NODAN ALM RCVR B
LOCK ALM CONT RCVR
LOCK ALM COM CONT RCVR
PILOT ALM RCVR B
PILOT ALM RCVR A
NODAN ALM RCVR A
BB RELAY DRIVE A
BB RELAY STATUS A
NOISE LEV RCVR A
NOISE LEV RCVR B
BB RELAY STATUS B
BB RELAY DRIVE B
GROUND
TO RCVR CONT
SET A ON RCVR
SET B ON RCVR
RESET RCVR
NODAN ALM RCVR B
LOCK ALM CONTACT RCVR
LOCK ALM COM CONT RCVR
PILOT ALM RCVR B
PILOT ALM RCVR A
NODAN ALM RCVR A
J9
NODAN ALM RCVR B
PILOT ALM RCVR B
BB RELAY DRIVE B
BB RELAY STATUS B
NOISE LEV RCVR B
-20V RCV B
AGC OUT RCVR B
SUM ALM CONT RCVR B
SUM ALM COM CONT RCVR B
PLT/NODAN ALM RCVR B
MTR LED RCVR B
AGC RCVR B
GROUND
TO RCVR B
AGC OUT RCVR B
SUM ALM CONT RCVR B
SUM ALM COM CONT RCVR B
PLT/NODAN ALM RCVR B
J5
SUM ALM XMTR B
TO EXTERNAL CONNECTION PANEL

SP-10376

SD-101376



REVISIONS		
ISSUE	APPROVED	DATE
1		

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:

MATERIAL:

FINISH:

PROCESS

USED ON FL1-2

SCALE — CHKD BY JS

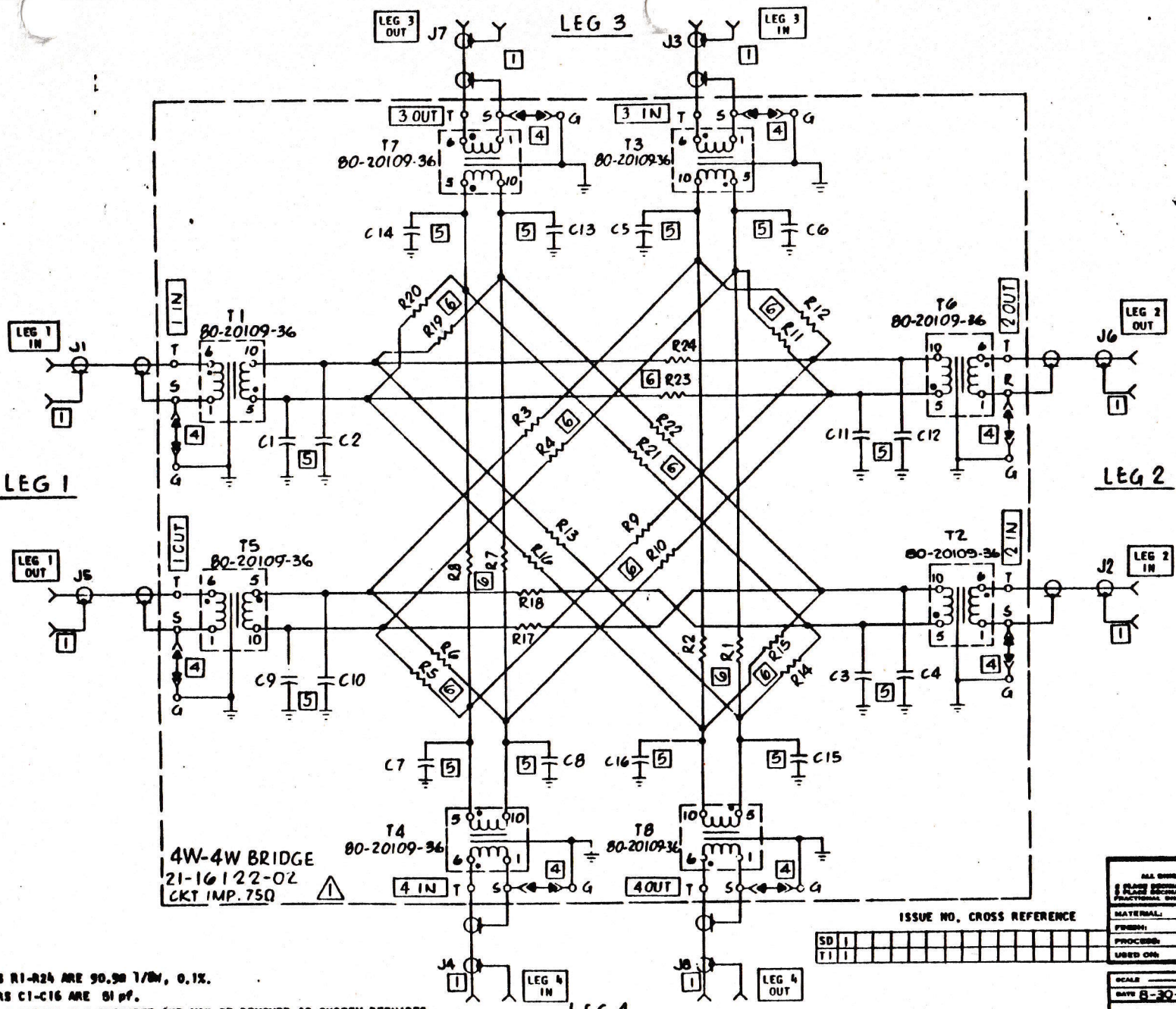
DATE 10-13-78 DRAWN BY VJ

Farinon

JUNCTION PANEL, PROT.

SHEET 1 OF 1 SHEETS

SD-101376 D



ISSUE NO. CROSS REFERENCE

SD	1
TI	1

6. RESISTORS R1-R24 ARE 90.9Ω 1/8W, 0.1%.
5. CAPACITORS C1-C16 ARE 81 pf.
4. ALL GROUND STRAPS ARE PROVIDED AND MAY BE REMOVED AS SYSTEM REQUIRES.
3. PHASE POLARITIES ARE INDICATED BY DOTS, CERTAIN COMBINATIONS OF BRIDGE LEGS WILL SHIFT PHASE OF SIGNALS BY 180°.
2. IF REPAIRS TO BRIDGE BECOMES NECESSARY, IT IS RECOMMENDED THAT IT BE RETURNED, AS COMPONENTS ARE NOT CONSIDERED FIELD REPLACEABLE.
1. TERMINATE ALL UNUSED BRIDGE LEGS.

NOTES:

27-M3

REVISIONS		
ZONE	APPROVED	DATE

SD-15127-M2 A & M ONLY AT ISSUE 2A. ECN 2065.

1	JH	10/12 73

SCALE		DRAWN BY PW	APP'D. JH
DATE 8-30-73		DRAWN BY SC	APP'D. RK

Farinon

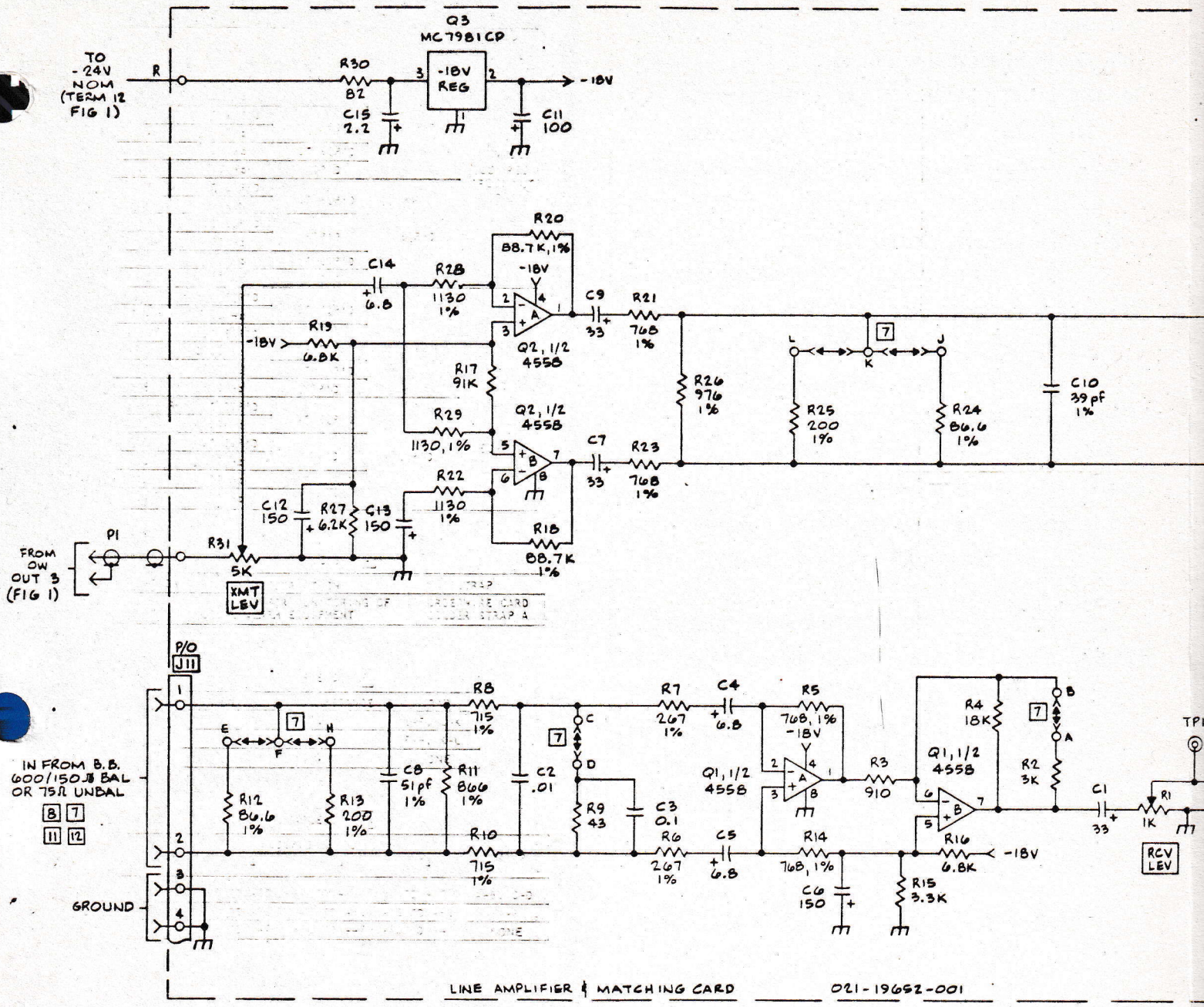
4 WAY- 4 WIRE BRIDGE
(300 Hz TO 3.0 MHz)

SHEET 1 OF 1 SHEETS

SD-15127-M3 C

FIG 2

LINE AMPLIFIER & MATCHING CARD



LINE AMPLIFIER & MATCHING CARD 021-19652-001

13 UNUSED PORTS DO NOT REQUIRE TERMINATION.

12 TEST METERS OR OSCILLATORS USED FOR ALIGNMENT OF 600Ω OR 150Ω BALANCED SERVICE MUST PROVIDE BALANCED CONNECTIONS; USE OF UNBALANCED TEST EQUIPMENT WILL CAUSE ERRONEOUS ADJUSTMENTS.

11 EXTERNAL ISOLATION TRANSFORMERS MUST BE PROVIDED WHEN CONNECTING TO OUTSIDE METALIC PAIRS.

10 FOR 2600 Hz SIGNALING C2 IS 7500 pF, C11 IS 7870 pf.
FOR 1800 Hz SIGNALING C2 IS 16,400 pF, C11 IS 16,500 pf.

9 SIGNALING LEVEL RANGE IS -6 TO -16dBmO. UNLESS OTHERWISE SPECIFIED R1 & R34 WILL BE SET FOR -6dBmO.

8 FOR UNBALANCED SERVICE, APPLY GROUND TO J11 PINS 2 & 6.

7 LINE AMPL & MATCHING CARD IMPEDANCE STRAPPING OPTIONS ARE PER TABLE C & RECEIVE LEVEL STRAPPING OPTIONS PER TABLE D.

6 2600Hz SIG CARD IS 021-19828-001. 1800Hz SIG CARD IS 021-19828-002.

5 FACTORY SELECTED COMPONENT, NOMINAL VALUE: R43-68K; R35-1K.

4 BASIC ORDERWIRE CARD STRAPPING OPTIONS ARE PER TABLE B.

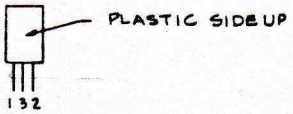
3 EQUIPMENT OPTIONS ARE PER TABLE A.

2. COMPONENT TYPE NUMBERS AND VALUES ARE THOSE NORMALLY PROVIDED. SUBSTITUTIONS OF EQUIVALENT TYPES OR DIFFERING VALUES THAT DO NOT DEGRADE PERFORMANCE MAY BE MADE AT THE TIME OF MANUFACTURE.

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ±5%, 1/4W; 1% RESISTORS ARE 1/8W, AND CAPACITOR VALUES ARE IN MICROFARADS.

NOTES:

-18V REG BASE DIAGRAM



14 THIS UNIT DIFFERS FROM STANDARD IN THAT THE FILTER CONSISTING OF C20, C21, C22, C23, C24, L3, L4 IS REPLACED BY FILTER 081-017770-002.

SD-19379-M2-80907		
REVISIONS		
ISSUE	APPROVED	DATE
ECN 7182.		
1	RS.	5/9 80

[6] TABLE A [3]

OPTION	SIGNALING CARD	AUX INPUT BP FLT FLI 4.4-6.9 kHz	LINE AMPL & MATCHING CARD	INPUT VOLTAGE
001	NOT EQP'D	NOT EQP'D	NOT EQP'D	-21 TO -28V DC (Q201, R201, CR201 NOT EQP'D)
002	2600 Hz			
003	NOT EQP'D	EQP'D		
004	2600 Hz			
005	1800 Hz	NOT EQP'D		
006	1800 Hz	EQP'D		
007	NOT EQP'D	NOT EQP'D	EQP'D	
008	2600 Hz			
009	NOT EQP'D	EQP'D		
010	2600 Hz			
011	1800 Hz	NOT EQP'D		
012	1800 Hz	EQP'D		
013	NOT EQP'D	NOT EQP'D	NOT EQP'D	-42 TO -56V DC (Q201, R201, CR201 EQP'D)
014	2600 Hz			
015	NOT EQP'D	EQP'D		
016	2600 Hz			
017	1800 Hz	NOT EQP'D		
018	1800 Hz	EQP'D		
019	NOT EQP'D	NOT EQP'D	EQP'D	
020	2600 Hz			
021	NOT EQP'D	EQP'D		
022	2600 Hz			
023	1800 Hz	NOT EQP'D		
024	1800 Hz	EQP'D		

TABLE B [4]

OPTION	DESCRIPTION	STRAP
A	PROVIDES FOR MONITORING OF LOCAL ALARM EQUIPMENT	ORDERWIRE CARD SOLDER STRAP A

TABLE C [7]

OPTION	LINE IMPEDANCE	STRAP
X	75Ω	E-F, J-K
Y	150Ω	F-H, K-L
Z	600Ω	NONE

TABLE D [7]

OPTION	RECEIVE LEVEL (dBm)			STRAP
	600Ω	150Ω	75Ω	
R	+7 TO -20	0 TO -13	0 TO -12	A-B, C-D
S	-20 TO -36	-13 TO -32	-12 TO -30	A-B
T	-36 TO -47	-32 TO -47	-30 TO -47	NONE

P/O J11

5

6

OUT TO B.B. 600/150Ω BAL OR 75Ω UNBAL

[8] [7]

[11] [12]

P1 (YEL)

P2

TP2 (BK)

TO OW IN 3 (FIG 1)

△1

LAST NUMBERS USED

LINE AMPLIFIER & MATCHING CARD

Q3, TP2, P2, J11, C15, R31.

ISSUE NUMBER CROSS REFERENCE

SD	1								
T1	1								

△	DENOTES CIRCUIT BOARD ISSUE NO.
—○—	DENOTES TURRET LUG FOR WIRING OR STRAPPING PURPOSES.
—●—	DENOTES CIRCUIT JUNCTION POINT
SYM	DESCRIPTION
LEGEND	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE
2 PLACE DECIMALS ± .015" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA ± .002"
FRACTIONAL DIMENSIONS ± 1/64"

MATERIAL

FINISH

PROCESS

USED ON

SCALE —— | ENGR BY JB | APP'VD

DATE 6-24-76 | DRAWN BY MSH | APP'VD RE

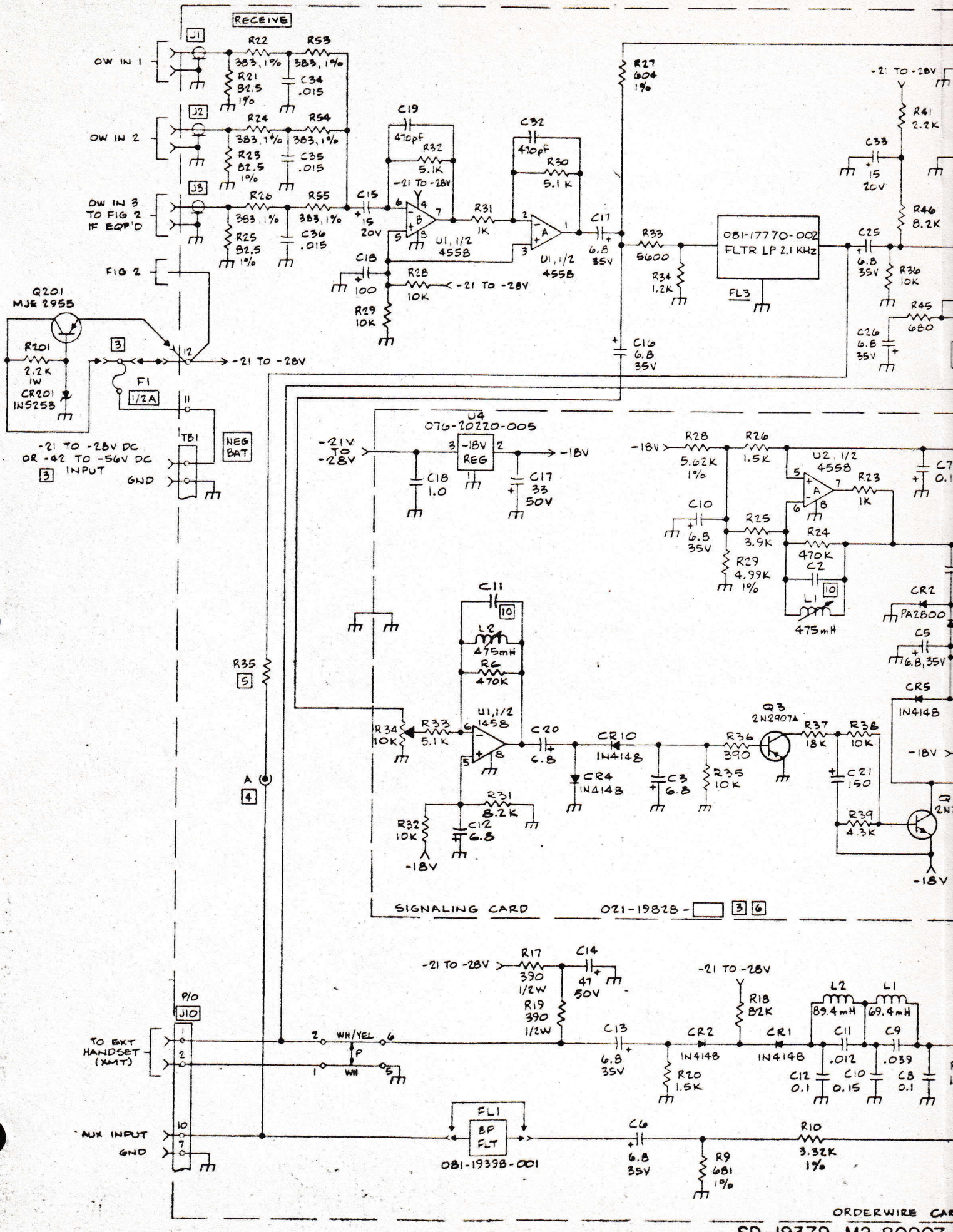
Farinon

ORDERWIRE

ORIG DIST 5 | SHEET 1 OF 2 SHEETS | DWG SIZE

SD-19379-M2-80907 D

07


RECEIVE
J1
J2
J3
OW IN 1
OW IN 2
OW IN 3
TO FIG 2
IF EQP'D
FIG 2
R22
R53
R24
R54
R26
R55
R21
82.5
1%
R23
R25
383, 1%
C34
.015
C35
C36
C19
470pF
R32
5.1K
C32
R30
5.1 K
C15
15
20V
C18
100
R28
10K
-21 TO -28V
U1, 1/2
4558
R31
1K
C17
6.8
35V
R27
604
1%
R33
5600
R34
1.2K
081-17770-002
FLTR LP 2.1 KHz
FL3
C25
R36
10K
R41
2.2K
C33
R46
8.2K
R45
680
C26
Q201
MJE 2955
R201
2.2K
1W
CR201
IN5253
F1
1/2A
-21 TO -28V DC
OR -42 TO -56V DC
INPUT
TB1
NEG
BAT
GND
U4
076-20220-005
-21V
TO
-28V
-18V
REG
C16
6.8
35V
R28
5.62K
1%
R26
1.5K
U2, 1/2
4558
R23
1K
C10
6.8
35V
R25
3.9K
R24
470K
R29
4.99K
1%
C2
L1
475mH
CR2
PA2800
C5
6.8, 35V
C11
L2
475mH
R6
470K
R35
A
R33
5.1K
U1, 1/2
1458
C20
6.8
CR10
IN4148
CR4
IN4148
C3
6.8
R36
390
Q3
2N2907A
R37
18K
R38
10K
C21
150
R39
4.3K
CR5
IN4148
R31
8.2K
R32
10K
C12
6.8
SIGNALING CARD
021-19828-
R17
390
1/2W
C14
47
50V
R19
390
1/2W
C13
6.8
35V
R18
82K
CR2
IN4148
CR1
IN4148
L2
89.4mH
L1
69.4mH
C11
.012
C9
.039
C12
0.1
C10
0.15
C8
0.1
R20
1.5K
P/O
J10
TO EXT
HANDSET
(XMT)
WH/YEL
WH
AUX INPUT
GND
FL1
BP
FLT
081-19398-001
C6
6.8
35V
R9
681
1%
R10
3.32K
1%
ORDERWIRE CA

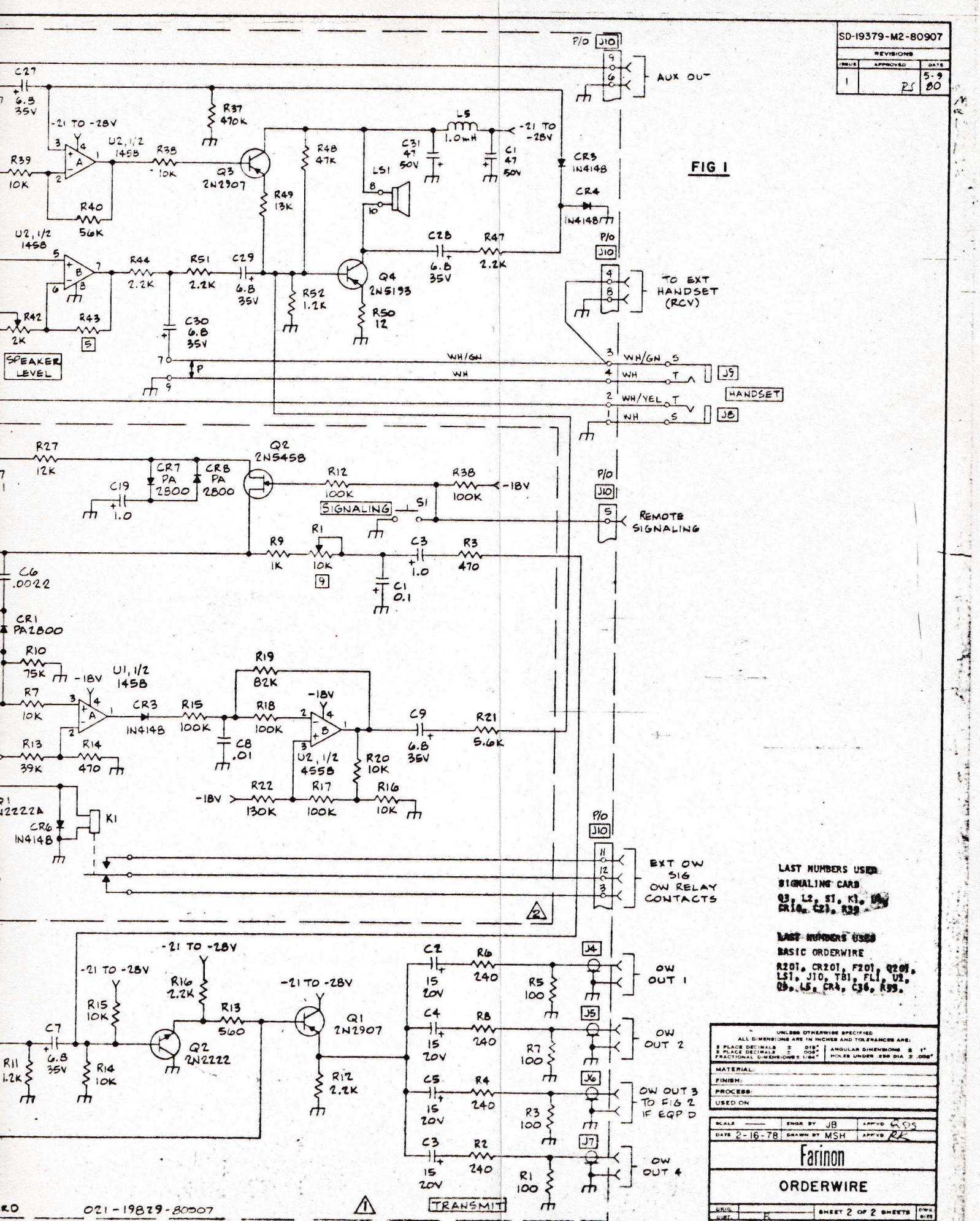

SD-19379-M2-80907
REVISIONS
ISSUE | APPROVED | DATE
1 | RS | 5-9-80
FIG 1
P/O J10
AUX OUT
-21 TO -28V
C27 6.8 35V
R37 470K
U2,1/2 1458
R38 10K
R39 10K
R40 56K
Q3 2N2907
R48 47K
R49 13K
LS1
C31 47 50V
LS 1.0mH
C1 47 50V
CR3 IN4148
CR4 IN4148
C28 6.8 35V
R47 2.2K
P/O J10
TO EXT HANDSET (RCV)
U2,1/2 1458
R44 2.2K
R51 2.2K
C29 6.8 35V
Q4 2N5193
R52 1.2K
R50 12
R42 2K
R43
C30 6.8 35V
SPEAKER LEVEL
WH/GN
WH
WH/GN S
WH T
J9
HANDSET
WH/YEL T
WH S
J8
R27 12K
Q2 2N5458
CR7 PA 2800
CR8 PA 2800
C19 1.0
R12 100K
R38 100K
-18V
SIGNALING
S1
P/O J10
REMOTE SIGNALING
R1 10K
R9 1K
C3 1.0
R3 470
C1 0.1
C6 .0022
CR1 PA2800
R10 75K
-18V
U1,1/2 1458
R19 82K
R7 10K
CR3 IN4148
R15 100K
R18 100K
C8 .01
U2,1/2 4558
C9 6.8 35V
R21 5.6K
R13 39K
R14 470
R20 10K
R22 130K
R17 100K
R16 10K
K1
CR6 IN4148
P/O J10
EXT OW 516 OW RELAY CONTACTS
-21 TO -28V
R16 2.2K
R15 10K
R13 560
Q1 2N2907
Q2 2N2222
C7 6.8 35V
R11 1.2K
R14 10K
R12 2.2K
C2 15 20V
R6 240
R5 100
J4
OW OUT 1
C4 15 20V
R8 240
R7 100
J5
OW OUT 2
C5 15 20V
R4 240
R3 100
J6
OW OUT 3 TO FIG 2 IF EQP D
C3 15 20V
R2 240
R1 100
J7
OW OUT 4
TRANSMIT
LAST NUMBERS USED
SIGNALING CARD
Q3, L2, S1, K1, CR10, C21, R39
LAST NUMBERS USED
BASIC ORDERWIRE
R201, CR201, F201, Q201, LS1, J10, TB1, FL1, U2, Q5, L5, CR4, C36, R55.
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .010" | ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005" | HOLES UNDER .250 DIA ± .002"
FRACTIONAL DIMENSIONS ± 1/64"
MATERIAL:
FINISH:
PROCESS:
USED ON
SCALE | ENGR BY JB | APPVD
DATE 2-16-78 | DRAWN BY MSH | APPVD
Farinon
ORDERWIRE
SHEET 2 OF 2 SHEETS
SD-19379M2-80907 D
021-19829-80907

FIG 1A

BASIC SHELF (-24V) [2]

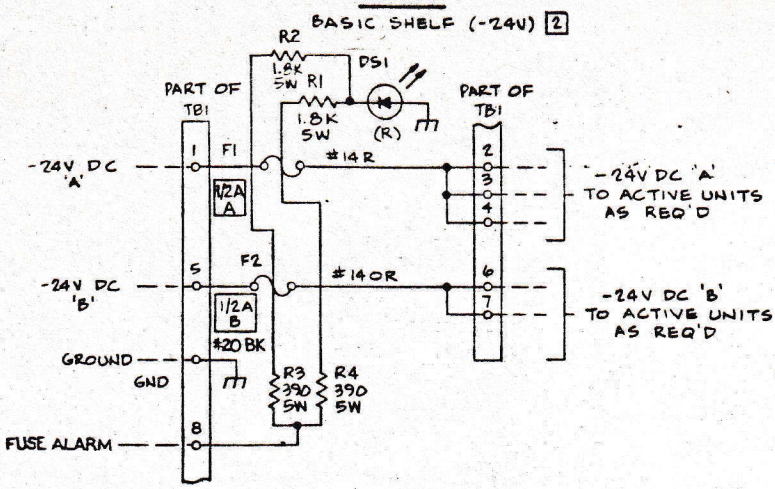


FIG 1B

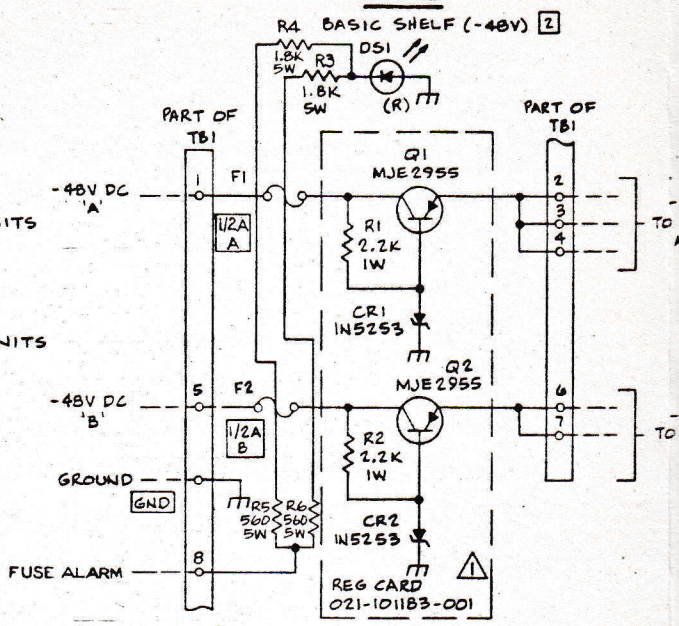


FIG 4

'Y' PAD PER SD-17657 OR HYBRID PER SD-19796 [1]

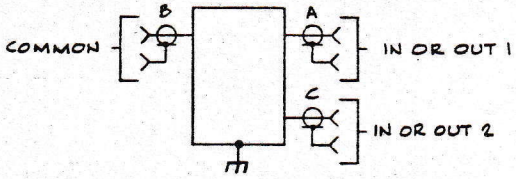


FIG 5

BB SPLITTING/COMBINING AMPLIFIER PER SD-19865 [1]

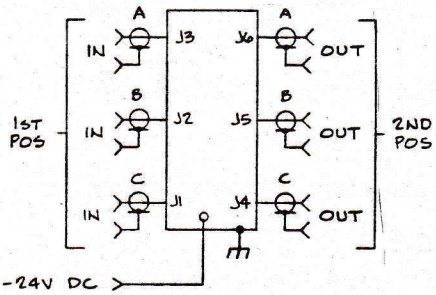


FIG 6

LINE AMPLIFIER PER SD-19948 [

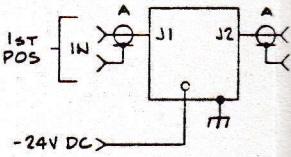


FIG 8

REDUNDANT BB SPLITTING/COMBINING AMPLIFIER PER SD-100521 [1] [5]

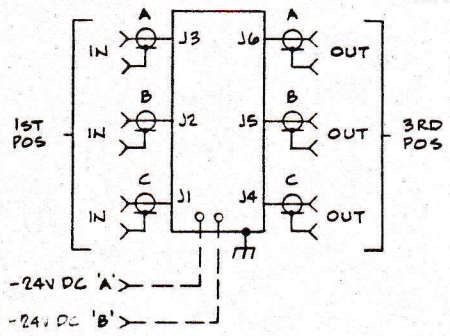
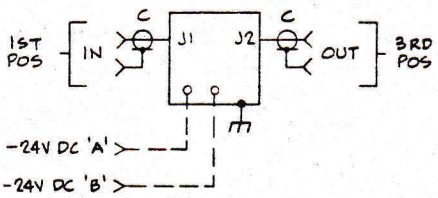
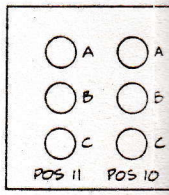


FIG 9

REDUNDANT LINE AMPLIFIER PER SD-100561 [1] [5]





OPTI
001
002
003
004

[7] FOR SPECIAL APPLICATIONS, FILTERS OTHER THAN THOSE SPECIFIED MAY BE USED. SPECIAL FILTERS WILL BE DEFINED IN RA[illegible].

[6] POS. 1 IS NOT AVAILABLE IN OPT 003 OR 004.

[5] FIGURES 8 & 9 REQUIRE 3 ADJACENT POSITIONS.

[4] CABLE SHIELDS MAY BE GROUNDED, TIED THRU, OR LEFT OPEN, AS REQUIRED.

[3] ADAPTOR PLATE OCCUPIES TWO ADJACENT MOUNTING POSITIONS AND WILL ACCOMMODATE 1 OR 2 TRANSFORMERS.

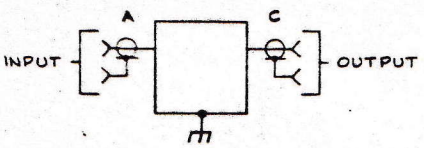
[2] EQUIPMENT OPTIONS ARE PER TABLE A.

[1] THIS PANEL OCCUPIES 2 RACK SPACES. SPECIFIY UNITS REQUIRED PER APPROPRIATE SD DRAWING AND MOUNTING POSITION. FIGURES 3, 5 & 6 REQUIRE 2 ADJACENT POSITIONS.

NOTES:

FIG 2

HP, LP OR BP FILTER OR EMPHASIS PER SD-19797 T OR π PAD PER SD-19901 OR COAXIAL ADJUSTABLE PAD PER SD-19946 [1] [7]

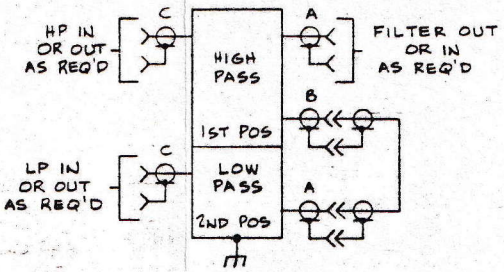


24V DC 'A' ACTIVE UNITS AS REQ'D

24V DC 'B' ACTIVE UNITS AS REQ'D

FIG 3

LINE SEPARATION FILTER PER SD-19797 [1] [7]

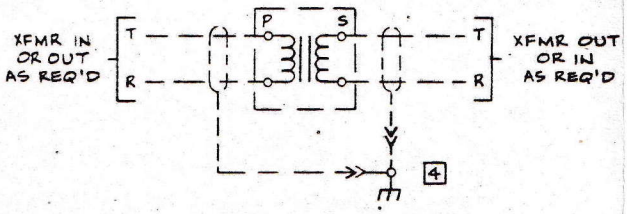


[1]

OUT — 2ND POS

FIG 7

MATCHING TRANSFORMER PER SD-100263 [2] [3]



DETAIL A

REAR VIEW [1]

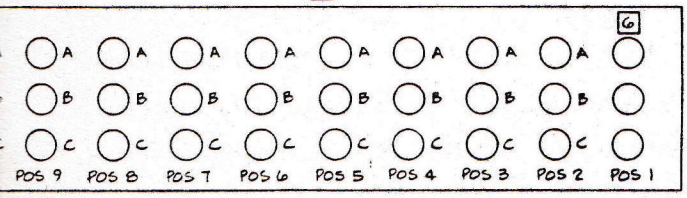


TABLE A [2]

ION	DESCRIPTION
1	STANDARD SHELF PER FIG. 1A FOR -24V PRIMARY POWER AND FOR MOUNTING UNITS WITH COAXIAL CONNECTORS.
2	SAME AS OPTION 001 BUT ADDS ADAPTOR PLATE FOR MOUNTING "WIRED IN" TRANSFORMER PER FIG. 7 [3]
3	STANDARD SHELF PER FIG. 1B FOR -48V PRIMARY POWER AND FOR MOUNTING UNITS WITH COAXIAL CONNECTORS.
4	SAME AS OPTION 003 BUT ADDS ADAPTOR PLATE FOR MOUNTING "WIRED IN" TRANSFORMER PER FIG. 7 [3]

TI NOT REQUIRED

SD-19950		
REVISIONS		
ISSUE	APPROVED	DATE
1	98	6/1 76
	FIG 7 & OPT 002 ADDED PER ECN 4813A.	
	A RDS	5/2 77
FIG 8 ADDED. "B" CKT ADDED TO FIG 1 TB1-1 WAS GND, -2 WAS 24V IN, 3,4,5, & 6 WERE 24V OUT. ECN 4995.		
2	RDS	6/7 77
FIGURE 9 AND NOTE 5 ADDED PER ECN 5511.		
3	RDS	9/20 77
ADDED OPTS. 003 & 004 PER ECN 6131.		
4	RDS (98)	5/8 78
NOTE 7 ADDED. ECN 6280.		
5	[illegible]	8/25 78
DET A; A, B, & C DELETED FROM POS. 1. ECN 6797.		
6	RDS	7/5 79
FIG. 1A, 1B FUSE ALM & ASSOC. RES. ADDED. (PIN 8 WAS CONN. TO 24V 'B') ECN 6978.		
7	RK	12/5 79

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .010" | 3 PLACE DECIMALS ± .005" | FRACTIONAL DIMENSIONS ± 1/64" | ANGULAR DIMENSIONS ± 1° | HOLES UNDER .250 DIA ± .002"

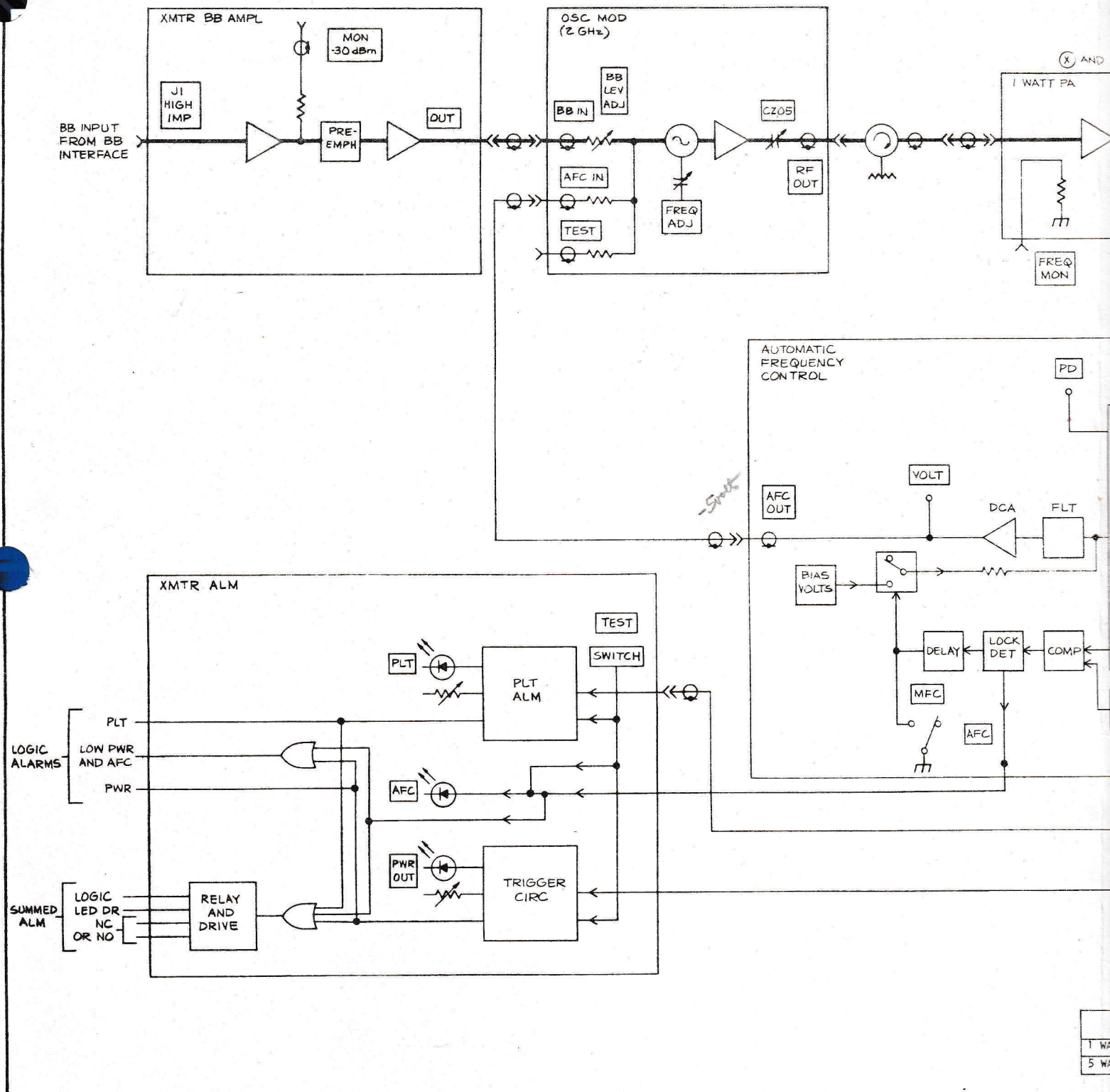
MATERIAL:
FINISH:
PROCESS:
USED ON:

SCALE —	ENGR. BY RDS	APP'VD.
DATE 5-4-78	DRAWN BY MSH	APP'VD.

Farinon

AUXILIARY EQUIPMENT SHELF

ORIG. DIST.	SHEET 1 OF 1 SHEETS	DWG SIZE
SD-19950		D



NOTES:

1. POWER OPTIONS SHOWN IN TABLE A.
2. CIRCULATOR & EXTERNAL 50Ω LOAD EQUIPPED ONLY ON COAX SWITCH MNSB SYSTEMS.

BL-101241

BL-101241

REVISIONS		
ISSUE	APPROVED	DATE
1	DD	12-20-78

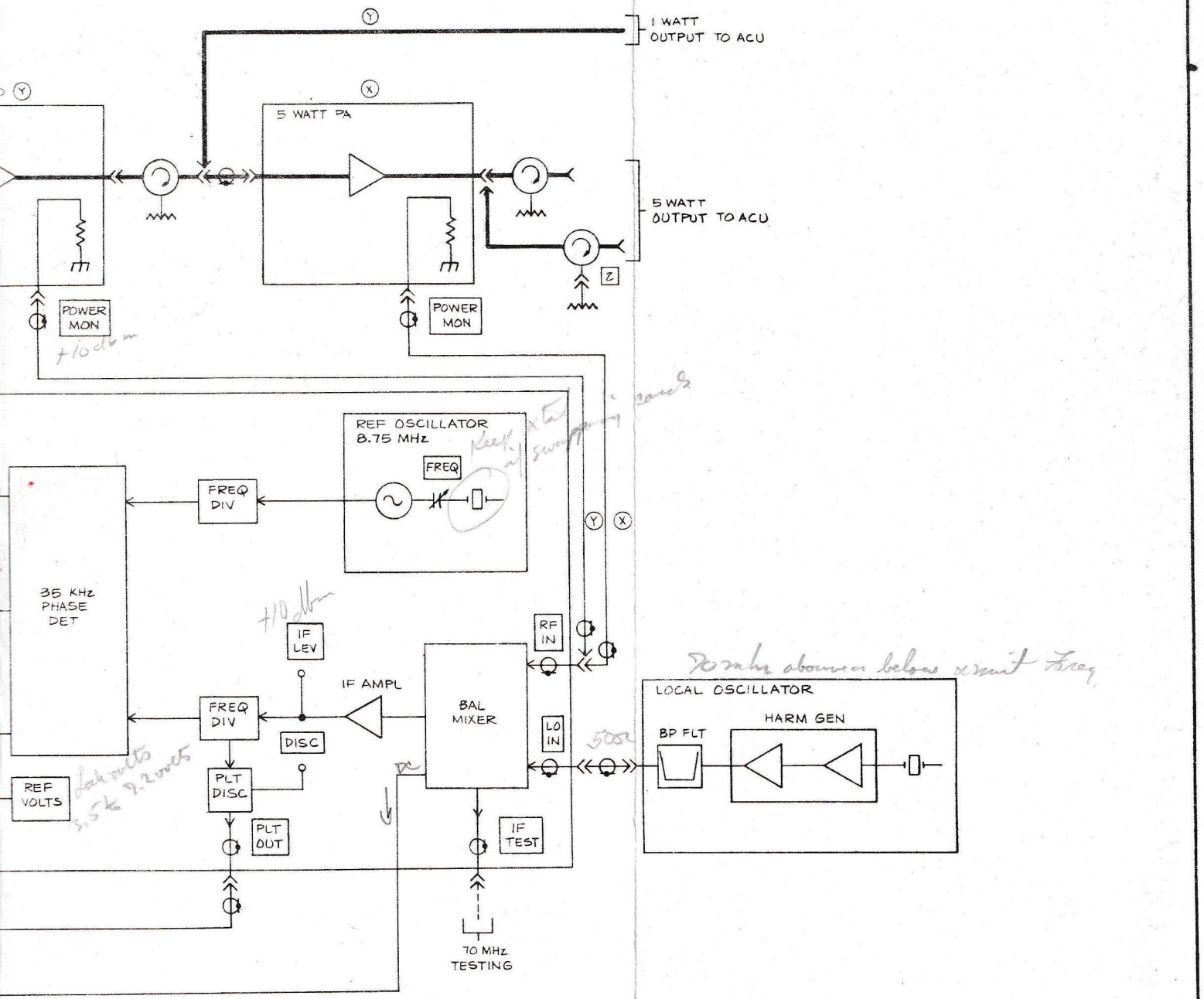


TABLE A [1]

DESCRIPTION	WIRING EQPT
WATT POWER OUTPUT	Y
WATT POWER OUTPUT	X

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:			
2 PLACE DECIMALS ± .015"	3 PLACE DECIMALS ± .005"	FRACTIONAL DIMENSIONS ± 1/64"	ANGULAR DIMENSIONS ± 1° HOLES UNDER .250 DIA. ± .002"
MATERIAL:			
FINISH:			
PROCESS:			
USED ON: FL 1-2			

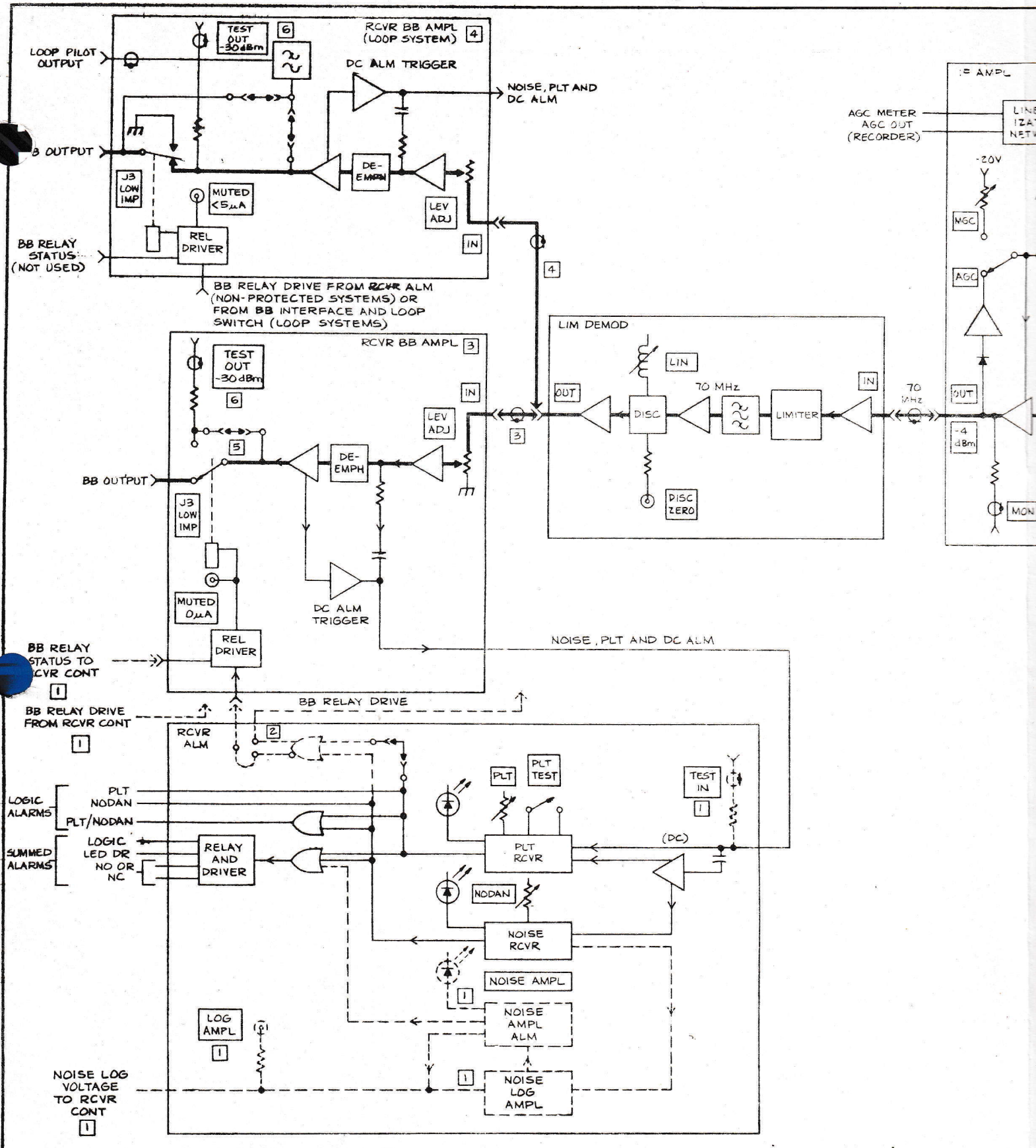
SCALE —	ENGR. BY DD	APP'VD.
DATE 10-23-78	DRAWN BY VJ	APP'VD.

Farinon

XMTR ASSY

ORIG.	SHEET 1 OF 1 SHEETS	DWG SIZE
DIST. R		

BL-101241 D



5 STRAP EQUIPPED FOR NON-PROTECTED SYSTEMS ONLY.

4 EQUIPPPED ONLY FOR NON-PROTECTED SYSTEMS AND LOOP SYSTEMS.

EQUIPPED FOR PROTECTED SYSTEMS.

2 THE BB RELAY DRIVE CIRCUIT IS EQUIPPED ONLY FOR NON-PROTECTED SYSTEMS AND LOOP SYSTEMS. FOR LOOP SYSTEMS THE BB RELAY DRIVE OUTPUT IS LEFT OPEN.

1 PROTECTED SYSTEMS ONLY.

NOTES:

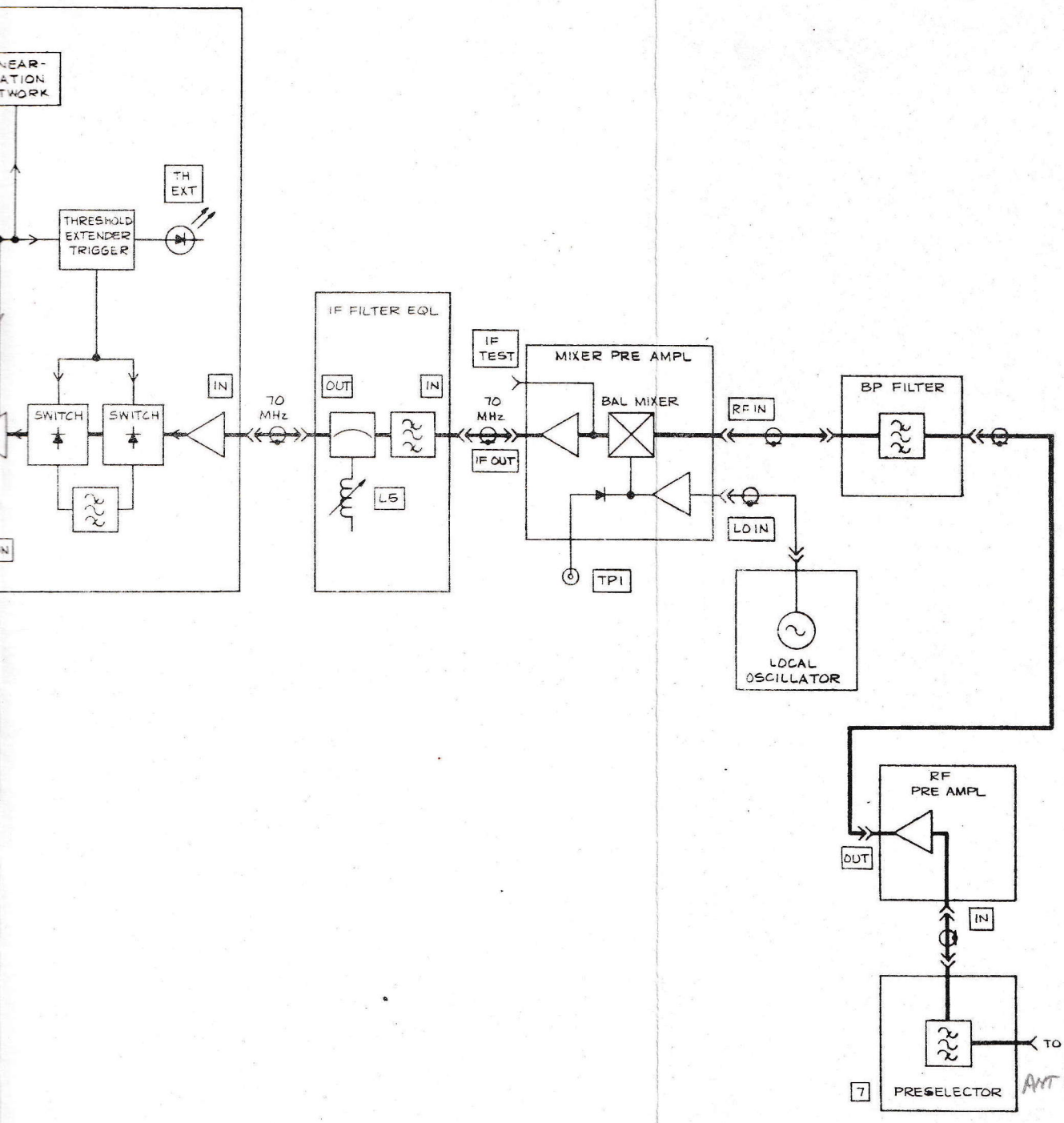
7 PRESELECTOR IS NOT NORMALLY EQUIPPED FOR COMMON ANTENNA PROTECTED SYSTEMS.

6 THIS LEVEL IS NOMINAL AND MAY BE ADJUSTED ±0.5 dB TO COMPENSATE FOR STATION CABLING AND FILTER LOSSES.

BL-101242

BL-101242

REVISIONS		
NO.	APPROVED	DATE
1	DD	12-20-78



Ant Coupling unit

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:			
X PLACE DECIMALS	± .015"	ANGULAR DIMENSIONS	± 1°
2 PLACE DECIMALS	± .005"	HOLES UNDER .250 DIA.	± .005"
FRACTIONAL DIMENSIONS	± 1/64"		

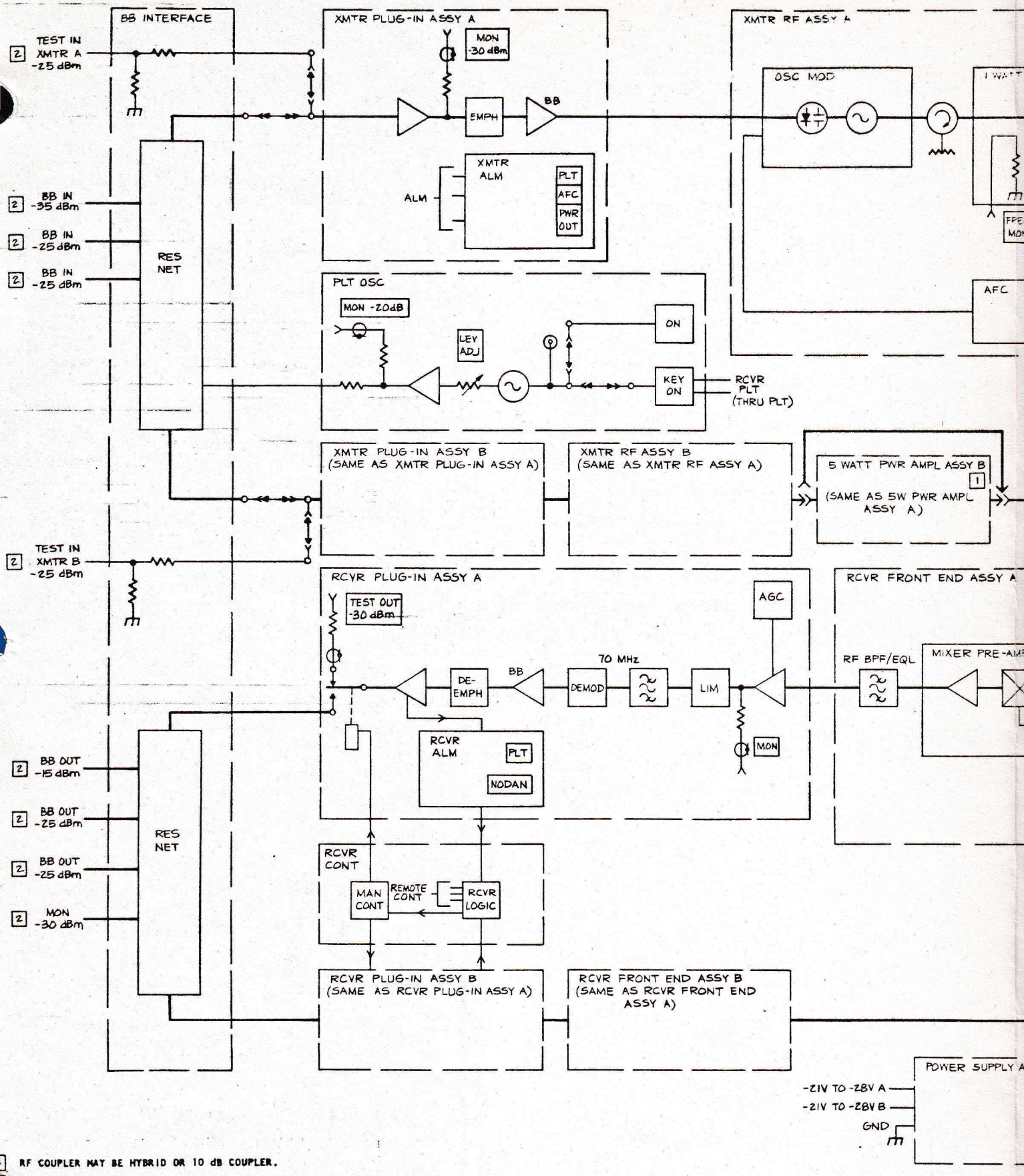
MATERIAL:		
FINISH:		
PROCESS:		
USED ON:	FL 1-2	

SCALE —	ENGR. BY DD	APP'VD.	
DATE 10-23-78	DRAWN BY VJ	APP'VD.	

Farinon

RCVR ASSY

ORIG. SHEET		SHEET 1 OF 1 SHEETS	SHEET SIZE
		BL-101242	D



[5] RF COUPLER MAY BE HYBRID OR 10 dB COUPLER.

[4] SPACE DIVERSITY CONFIGURATION.

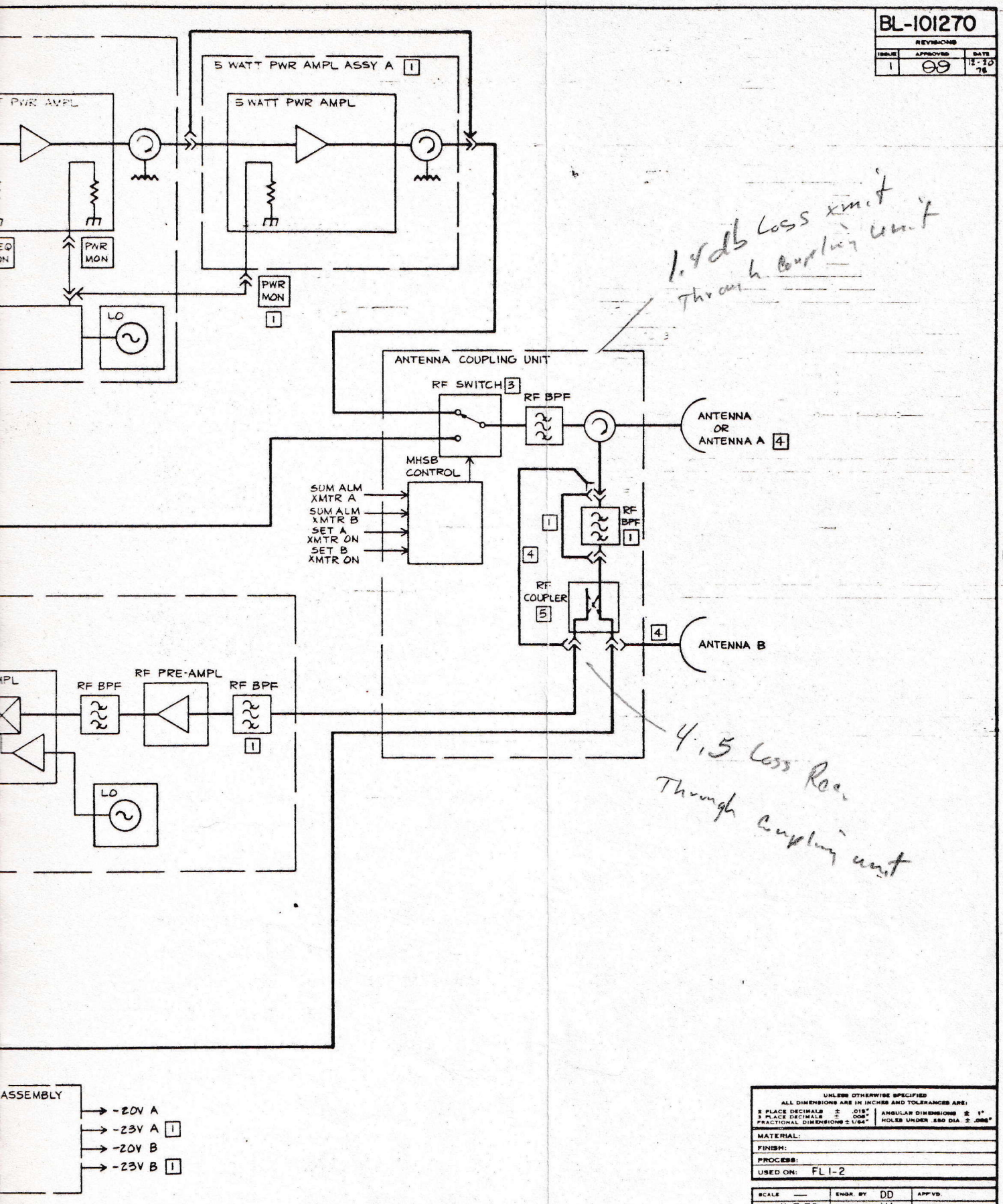
[3] ACU MAY CONTAIN COAX SWITCH (SD-101254) OR DIODE SWITCHES (SD-101255).

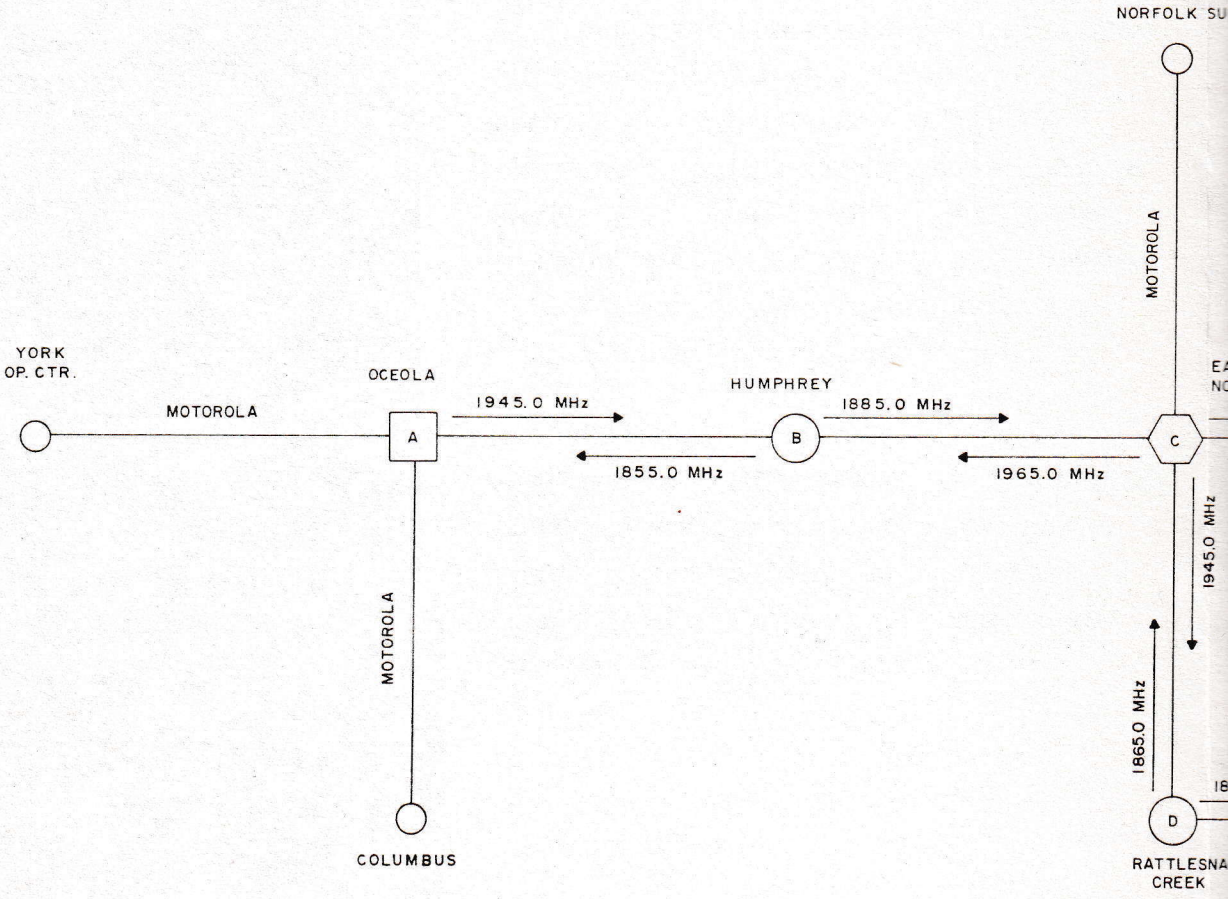
[2] LEVELS ARE NOMINAL AND MAY BE ADJUSTED ± 0.5 dB TO COMPENSATE FOR CABLING AND FILTER LOSSES.

[1] OPTIONAL ITEMS.

NOTES:

BL-101270


BL-101270
REVISIONS
ISSUE | APPROVED | DATE
1 | 99 | 12-20-78
5 WATT PWR AMPL ASSY A [1]
5 WATT PWR AMPL
PWR AMPL
PWR MON
PWR MON [1]
LO
1.4 db Loss xmit Through Coupling unit
ANTENNA COUPLING UNIT
RF SWITCH [3]
RF BPF
ANTENNA OR ANTENNA A [4]
MHSB CONTROL
SUM ALM XMTR A
SUM ALM XMTR B
SET A XMTR ON
SET B XMTR ON
RF BPF [1]
RF COUPLER [5]
ANTENNA B [4]
RF PRE-AMPL
RF BPF
RF BPF [1]
LO
4.5 Loss Rec. Through Coupling unit
ASSEMBLY
-20V A
-23V A [1]
-20V B
-23V B [1]
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ± .015"
3 PLACE DECIMALS ± .005"
FRACTIONAL DIMENSIONS ± 1/64"
ANGULAR DIMENSIONS ± 1°
HOLES UNDER .250 DIA ± .005"
MATERIAL:
FINISH:
PROCESS:
USED ON: FL1-2
SCALE —
ENGR BY DD
APP'VD.
DATE 11-7-78
DRAWN BY VJ
APP'VD.
Farinon
FL1-2 MHS ASSEMBLY
ORIG.
DIST.
SHEET 1 OF 1 SHEETS
BL-101270
D


NORFOLK SU
MOTOROLA
YORK
OP. CTR.
MOTOROLA
OCEOLA
A
1945.0 MHz
1855.0 MHz
HUMPHREY
B
1885.0 MHz
1965.0 MHz
C
EA
NO
1945.0 MHz
1865.0 MHz
MOTOROLA
COLUMBUS
D
RATTLESNA
CREEK

SL-79750

SL-79750		
REVISIONS		
ISSUE	APPROVED	DATE
1	NG	7-11-80

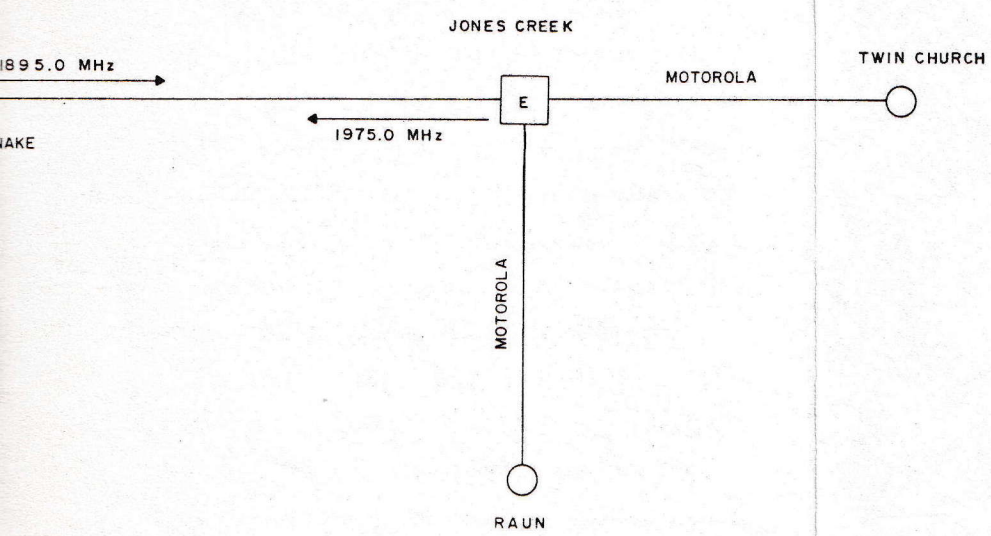
UB

EAST
NORFOLK
1985.0 MHz

HOSKINS

F

1905.0 MHz



CUSTOMER: NEB. PUB. POWER DIST.

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE	
2 PLACE DECIMALS ± .015"	ANGULAR DIMENSIONS ± 1°
3 PLACE DECIMALS ± .005"	HOLES UNDER .250 DIA ± .002"
FRACTIONAL DIMENSIONS ± 1/64"	
MATERIAL:	
FINISH:	
PROCESS:	
USED ON:	

SCALE		ENGR. BY NG	APP'VD YTT
DATE 4-17-80		DRAWN BY LIZ	APP'VD RK

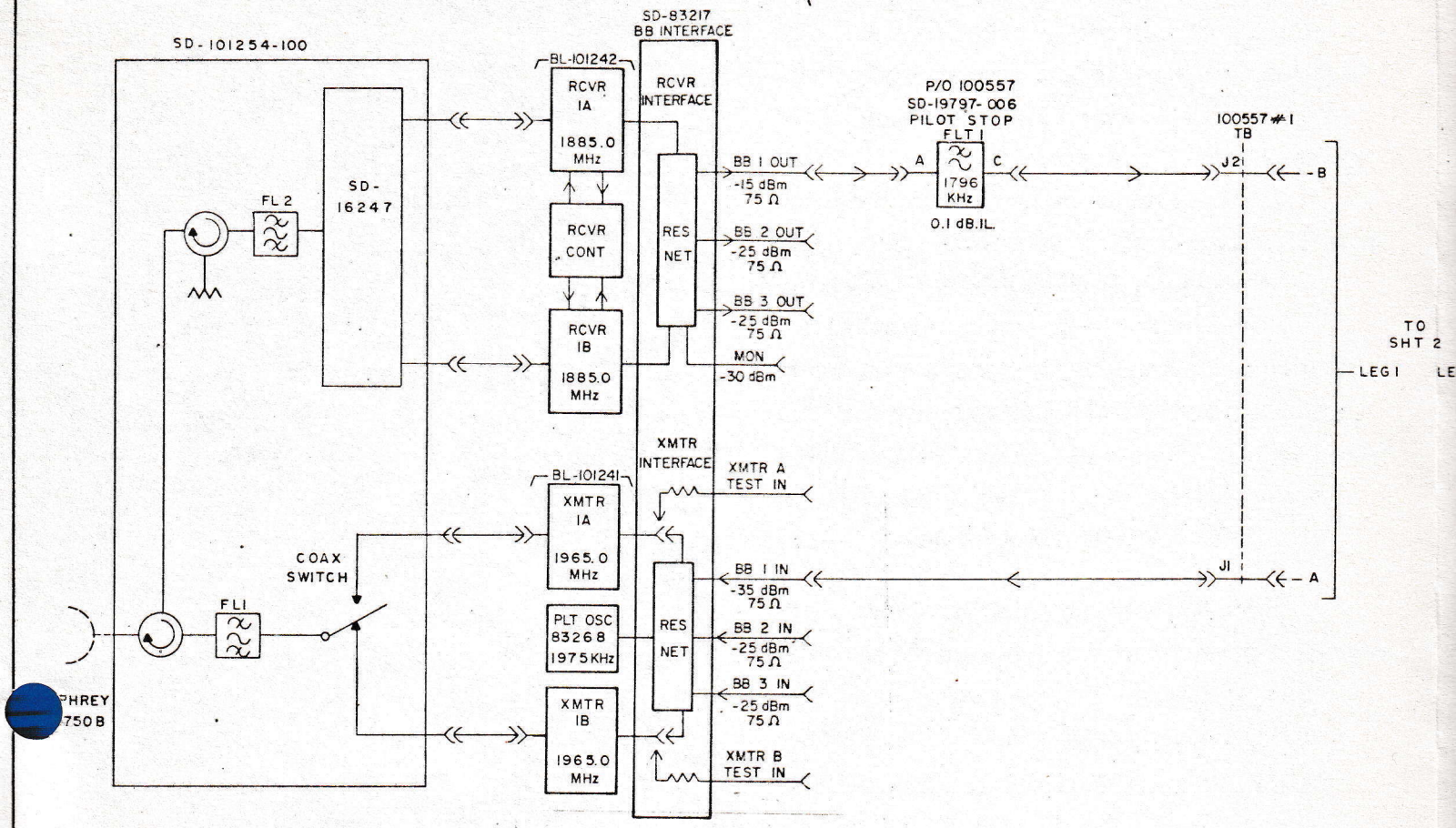
Farinon

SYSTEM LAYOUT

CAGE		SHEET 1 OF 1 SHEETS	DWG SIZE
SIZE			
SL-79750			D

P/O ASS'Y PER FWL-79750 C1

FL1-2 BL-101270



2. ____INDICATES CUSTOMER WIRING OR CONNECTION.

1. LEVELS SHOWN ARE NOMINAL TEST TONE LEVELS AND MAY VARY ±0.5 dB FROM THESE VALUES.

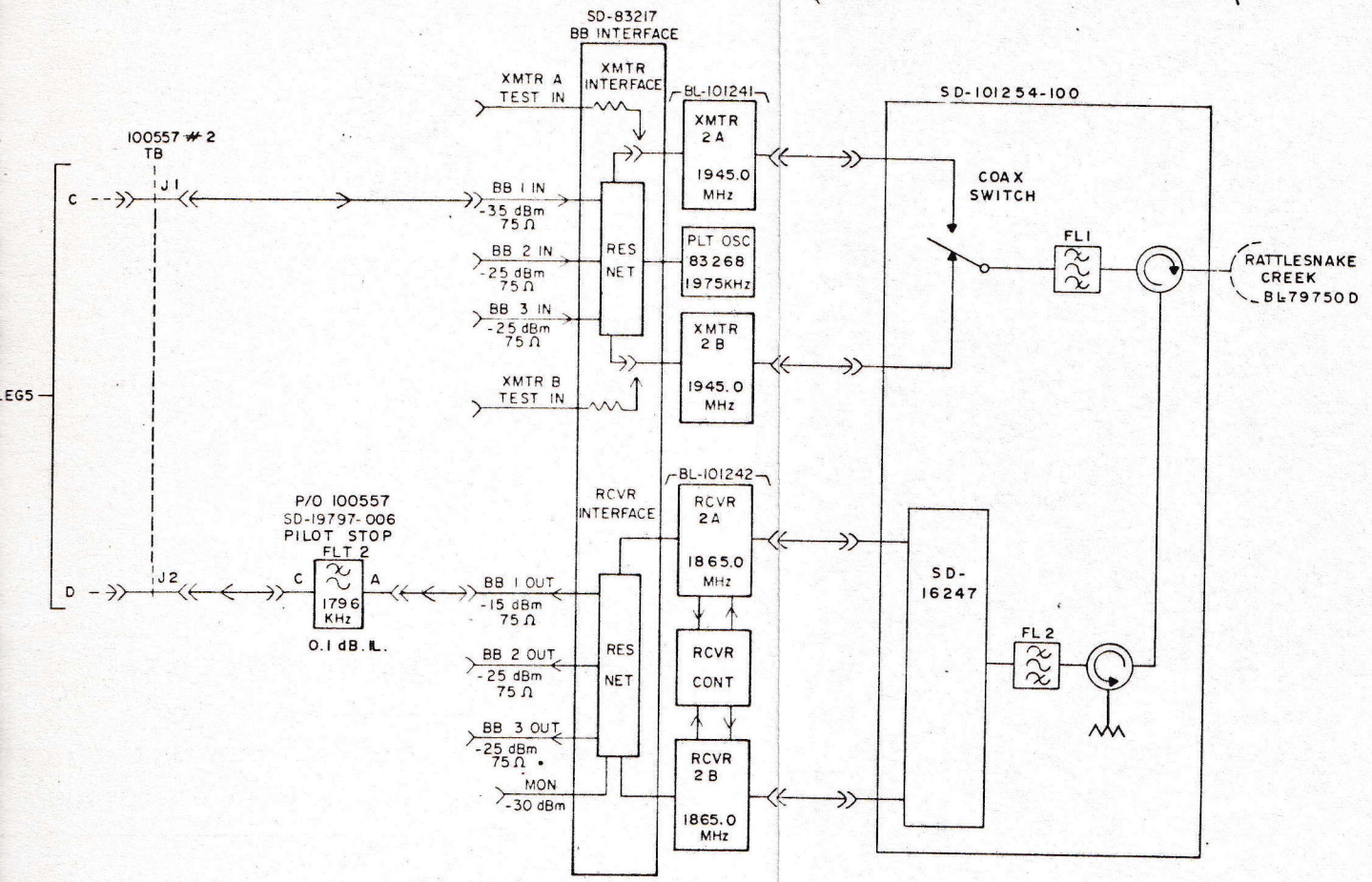
NOTES:

BL-79750C

REVISIONS		
SHEET	APPROVED	DATE
1	NG	5-11-80

P/O ASS'Y PER FWL-79750 C1

FL 1-2 BL-101270



CUSTOMER: NEB. PUBLIC POWER DIST.

LOCATION: EAST NORFOLK

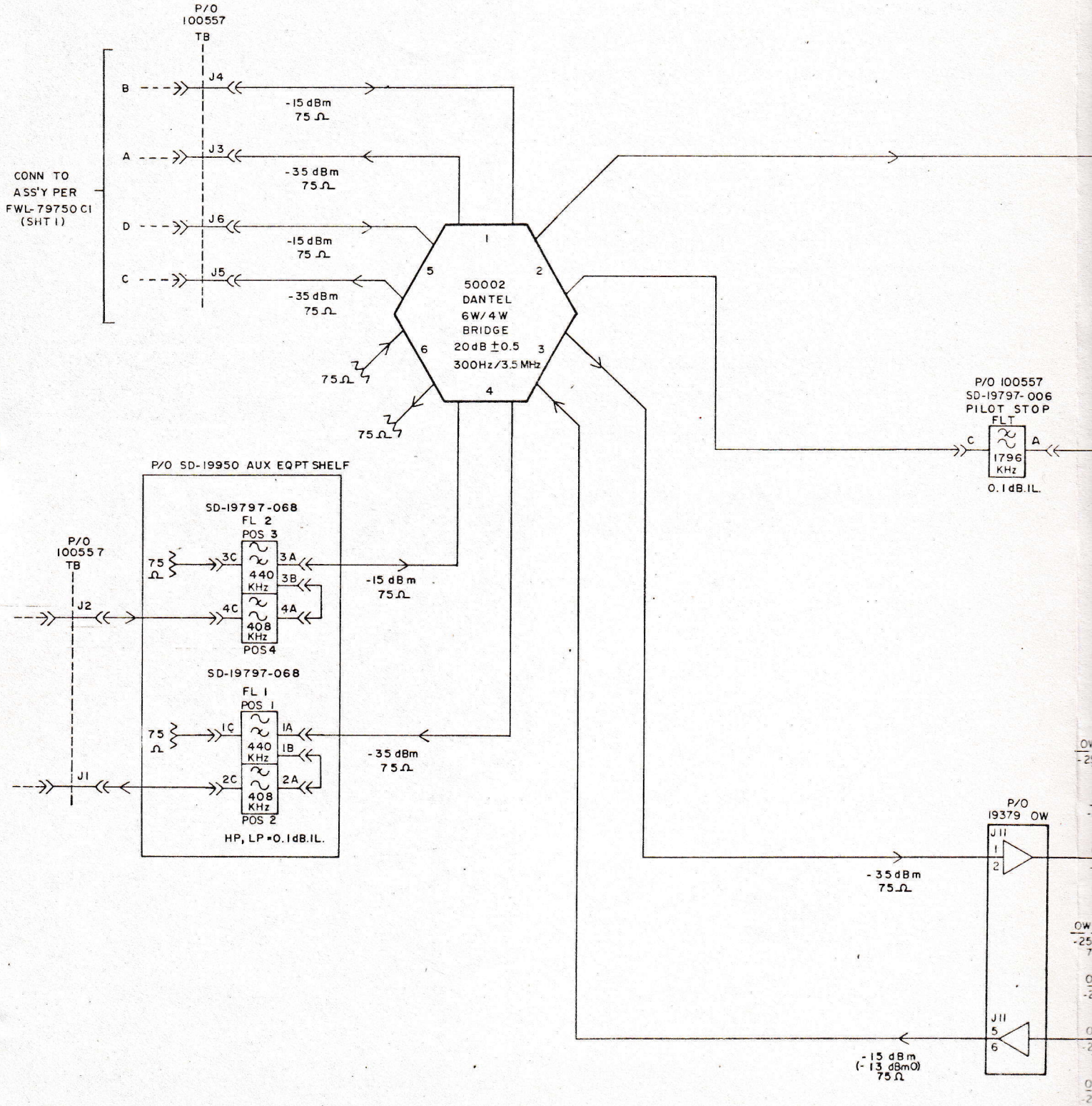
SCALE		DRAWN BY NG	APPROVED YTT
DATE 4-18-80		DRAWN BY LIZ	APPROVED RK

Farinon

BLOCK & LEVEL DIAGRAM
FL1-2 MHS RADIO ASS'Y

SHEET 1 OF 2 SHEETS

BL-79750 C D

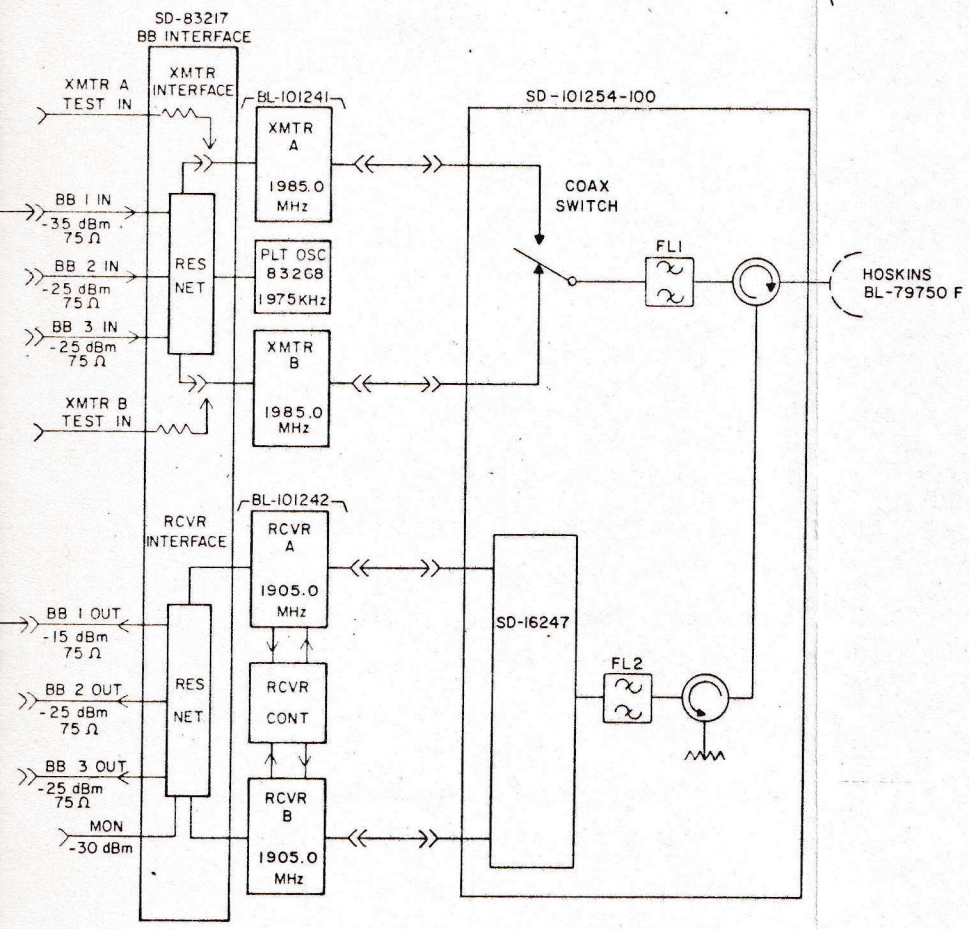

P/O 100557 TB
B
J4
-15 dBm 75 Ω
A
J3
-35 dBm 75 Ω
D
J6
-15 dBm 75 Ω
C
J5
-35 dBm 75 Ω
CONN TO ASS'Y PER FWL-79750 C1 (SHT 1)
50002 DANTEL 6W/4W BRIDGE 20dB ±0.5 300Hz/3.5 MHz
1
2
3
4
5
6
75 Ω
75 Ω
P/O 100557 SD-19797-006 PILOT STOP FLT
C
A
1796 KHz
0.1dB.IL.
P/O SD-19950 AUX EQPT SHELF
SD-19797-068 FL 2
POS 3
3C
3A
3B
440 KHz
4C
4A
408 KHz
POS4
P/O 100557 TB
J2
75 Ω
-15 dBm 75 Ω
SD-19797-068 FL 1
POS 1
1C
1A
1B
440 KHz
2C
2A
408 KHz
POS 2
J1
75 Ω
-35 dBm 75 Ω
HP, LP = 0.1dB.IL.
P/O 19379 OW
J11
1
2
-35 dBm 75 Ω
J11
5
6
-15 dBm (-13 dBm0) 75 Ω

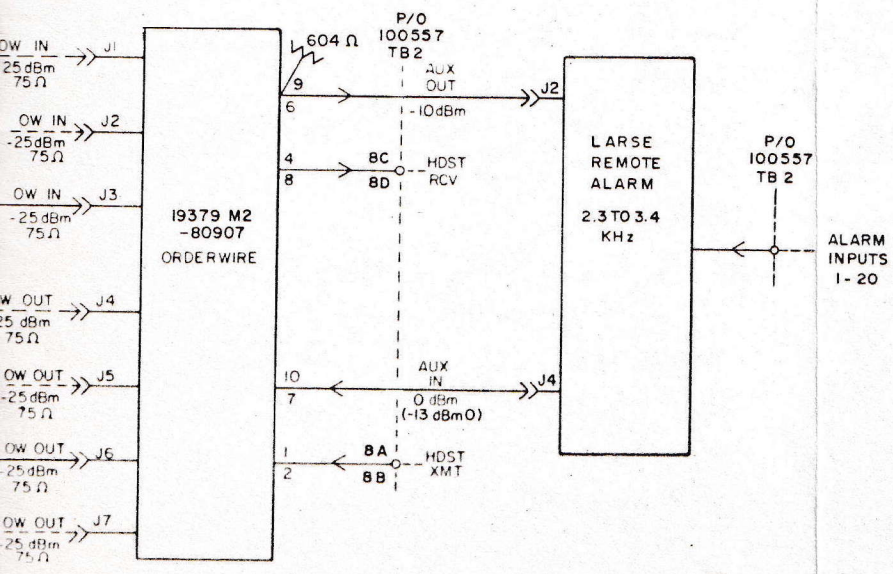
BL-79750 C

REVISIONS		
NO.	APPROVED	DATE
1	NG	7-11-80

L-79750 C 2

FL 1-2 BL-101270





CUSTOMER: NEB. PUBLIC POWER DIST.

LOCATION: EAST NORFOLK

SCALE	DRAWN BY NG	APPD. YTT
DATE 4-21-80	CHKD BY LIZ	APPD. RK

Farinon

BLOCK & LEVEL DIAGRAM
FL1-2 MHS RADIO ASS'Y

SHEET 2 OF 2 SHEETS

BL-79750 C D

REVISIONS		
ISSUE	APP VD	DATE
1	NG	6-12 80

Farinon

EQUIPMENT AND WIRING LIST FOR

GHz
300 ohm
Deviation
model (version)
WATTS
Pilot Freq (1975KHz)

FARINON DESIGNATOR: FL*2-W280-1-1W-2.0
FL1-2 MONITORED HOT STANDBY

INDEX

Customer:	Neb. Pub. Pwr. Dist.
Location:	East Norfolk
Purchase Order No.:	79-49
Farinon Sales Order No.:	79750
Coordinates With:	FWL-79750 F

REVISIONS		
ISSUE	APP'VD	DATE
1	NG	6-12 80

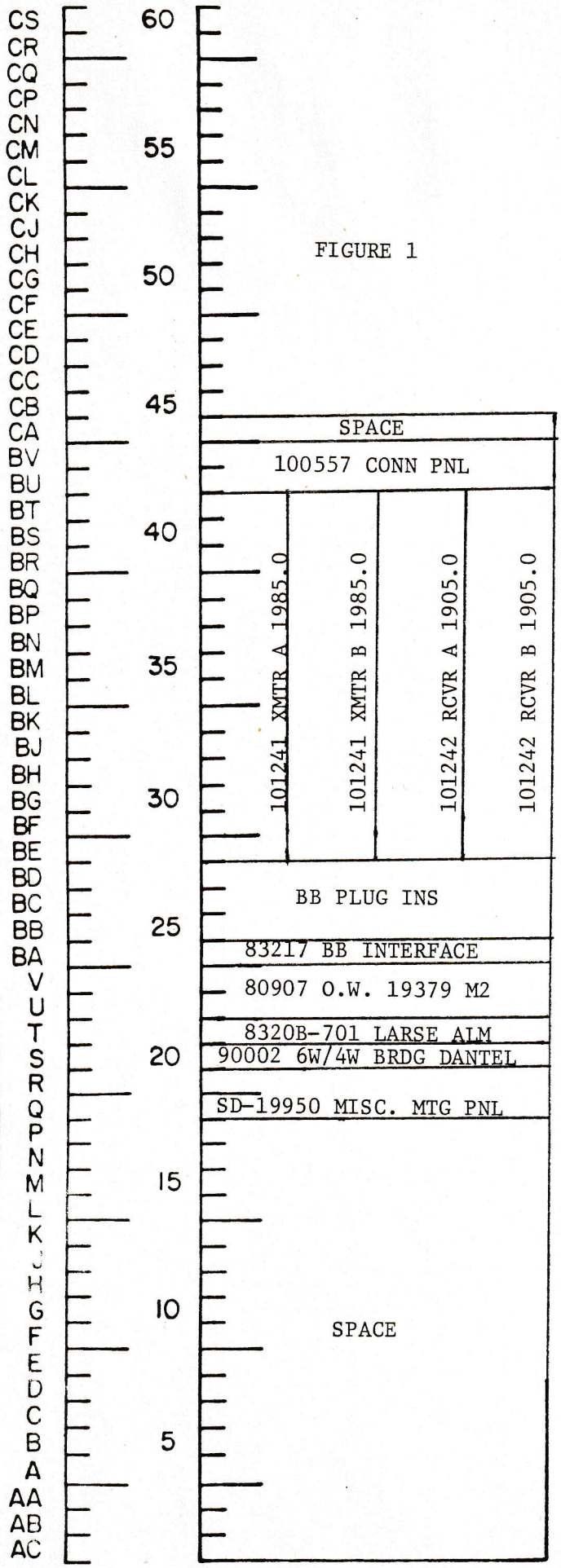


FIGURE 1

090-746015-503
7'0" EQUIPMENT RACK

FARINON EQUIPMENT LIST

FL1-2 MONITORED HOT STANDBY RADIO

FARINON DESIGNATOR: FL1*2-W280-1-1W-2.0

PRIME POWER -24VDC

DEVIATION 280 KHz

PILOT FREQ 1.975 MHz

BASEBAND CAPACITY 300 CHAN.

TRANSMITTER A FREQ: 1985.0 MHz SERIAL NO. 58132

TRANSMITTER B FREQ: MHz SERIAL NO. 58133

FCC XMTR DATA:

ITEM	DESCRIPTION	DRAWINGS				MPL ISSUE	QTY	REMARKS
		NUMBER	ISSUE	FIGURE	OPTION			
1								
2								
3								
4								
5	FL1-2 RADIO ASSEMBLY	SD-101270			001		1	
6	XMTR ASSEMBLY	SD-101241			003		2	Freq: 1985.0
7	XMTR BASEBAND AMPLIFIER	SD-83144			002		2	
8	OSCILLATOR-MODULATOR	SD-16243			003		2	Freq: ~~2055.0~~ 1985.0
9	1 W POWER AMPLIFIER	SD-101243			001		2	
10	5 W POWER AMPLIFIER	SD-101244						
11	AFC	SD-16241 M2			002, Y		2	
12	LOCAL OSCILLATOR	SD-16251			004		2	XTAL FREQ: 93.4091 (2055)
13	XMTR ALARM	SD-100861			004, Y		2	
14	XMTR PLUG-IN ASSEMBLY	190-101245						
15	XMTR RF ASSEMBLY	190-101276						
16	5W PA ASSEMBLY	190-101382						
17								
18								
19								
20								
21								
22								

REVISIONS

ISS	APP	DATE
1	NG	6-12 80

FARINON EQUIPMENT LIST

FL1-2 MONITORED HOT STANDBY RADIO

FARINON DESIGNATOR: FL1*2-W280-1-1W-2.0

PRIME POWER -24 VDC DEVIATION 280 PILOT FREQ: 1.975

BASEBAND CAPACITY 300 CHAN. BASEBAND BANDWIDTH KHz

RECEIVER A FREQ: 1905.0 MHz SERIAL NO. 58132 FCC XMTR DATA: FL1-2

RECEIVER B FREQ: MHz SERIAL NO. 58133 L.O. FREQ:

ITEM	DESCRIPTION	DRAWINGS				MPL ISSUE	QTY	REMARKS
		NUMBER	ISSUE	FIGURE	OPTION			
1								
2								
3								
4								
5	RCVR ASSEMBLY	SD-101242			002		2	Freq: 1905/L.O. 1835.0
6	RCVR BASEBAND ASSEMBLY	SD-83147			102		2	
7	LIMITER-DEMODULATOR	SD-83149-M2			001		2	
8	IF AMPLIFIER	SD-84202			001		2	
9	IF FILTER	SD-83167			002		2	
10	LOCAL OSCILLATOR	SD-16251			003		2	Freq: 91.7500 L.O. 1835.0
11	MIXER PREAMPLIFIER	SD-100084			002		2	
12	BANDPASS FILTER	SD-101103			005		2	Freq: 1905.0
13	RF PREAMPLIFIER	SD-18566			003		2	
14	RCVR ALARM	SD-83150			003, X		2	
15	RCVR PLUG-IN ASSEMBLY	190-101246						
16	RCVR FRONT END ASSEMBLY	190-101247						
17	DADE EQUALIZER	081-101290						
18								
19								
20								
21								
22								

REVISIONS

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1	NG	6-12 80

FARINON EQUIPMENT LIST

FL1-2 MONITORED HOT STANDBY RADIO

FARINON DESIGNATOR: FL1*2-W280-1-1W-2.0

COMMON EQUIPMENT/EXTERNAL CONNECTION PANEL

ITEM	DESCRIPTION	DRAWINGS				MPL ISSUE	QTY	REMARKS
		NUMBER	ISSUE	FIGURE	OPTION			
1	BASEBAND INTERFACE	SD-83217			001		1	
2								
3	PILOT OSCILLATOR	SD-83268			003, Y		1	
4	PILOT OSC PLUG-IN ASSY	SD-82871			001		1	
5								
6	RCVR CONTROL	SD-83160			001		1	
7	RCVR CONTROL PLUG-IN ASSY	SD-82885			001		1	
8		-						
9	METER PANEL	SD-83218 M2			001		1	
10	ANT COUPLING ASS'Y	SD-101254			100		1	
11	JUNCTION PANEL	SD-101376			001		1	
12	ACU SWITCH CONTROL (MHS)	SD-84201			001, A		1	
13	EXTERNAL CONN PANEL	SD-100557			004		1	
14	RF HYBRID	SD-16247			003		1	
15	DOOR ASSEMBLY	024-83339			002		1	
16	FILTER FL-2/FL-1	SD-16588			001		2	*
17	POWER SUPPLY ASSEMBLY	SD-101275			001		1	
18	PILOT STOP	SD-19797			006		1	
19	REGULATOR	SD-101282			001		2	
20	HP/LP FLT 408 KHz/440 KHz	SD-19797			068		2	
21	ORDERWIRE	80907-19379 M2			007, X,T		1	2.1 KHz L.P./Speach +
22	OPS SPARES	L161					1	

*NOTE:

	PASS	STOP
FL-2	1905	1985
FL-1	1985	1905

REVISIONS	ISS	APP	DATE
	1	NG	6-12 80

EQUIPMENT LIST

ITEM	DESCRIPTION	DRAWING					MPL ISS	QTY	REMARKS
		CODE	NUMBER	OPTIONS	FIG.	ISS			
	Terminal Block Panel								
	Jackfield								
	Shipping Bars (Set)								
	Equipment Rack		090-746015	503				1	7'0"
	Equipment Cabinet								
	Operating Spares Kit		11535						
	Operating Spares Kit		60329						
	Instruction Material (Set)								
	Instruction Books		FWL-79750 C2					1	
	Assembly Wiring		EW-79750 C2					1	
	Block and Level		BL-79750 C2					1	
			SL-79750					1	
	RF Coax		087-015229	036				1	
	Coax MTG Pnl		SD-19950	001				1	
	Larse Alms 2.3-3.4 KHz		8320B-701					1	
	6W/4W Brdg Dantel		90002					1	
	Headset		52AT-15-6WM-D-ER25					1	e/w Hook Loose
	RF Pad 10db Narda		4774-10					1	Loose
	Vendor Pubs							1	Lot

REVISIONS

ISSUE	APPVD	DATE
1	NG	6-12-80

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FACTORY TEST DATA

WIRING LIST NO: 79750 C2

POWER SUPPLY: -24V

INDEX: MONITORED HOT STANDBY SYSTEM

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Monitored Hot Standby

FL1-2 **SYSTEM TEST DATA**
(A & B SYSTEMS) COMBINED OPERATION

MESSAGE TYPE SYSTEM A

Date: 7/8/80

System Freq. 1905.0 MHz

Local Osc. Freq. 1835.0 MHz

Baseband Freq. .3 - 1300 kHz

Deviation 280 kHz rms per ch.

Bessel Zero -0.4 dBm0 AT 100kHz

RCVR Wiring List No. 79750-C2

Coordinating TX Wiring List No. 79750 F

Transmitter Input Level -25 dBm(Test-Tone)

Receiver Output Level -25 dBm(Test-Tone)

Pilot Freq. 1975.0 kHz

Baseband Response

(Reference to 100 kHz)

TX	Test Frequency (kHz)	.3	1	4	10	60	100	200	500	1 M.	1.3M.
A	Response (dB)	-.6	-.2	-.1	-.05	∅	∅	+.05	+.1	-.05	-.1
B	Response (dB)	-.55	-.15	-.05	-.05	∅	∅	+.05	+.15	∅	-.15

Noise Data Recordings

Noise Loading +9.8 dBm0 White Noise Load

RF Signal Input -36.5 dBm (at Antenna port)

BASIC INTRINSIC NOISE RATIO → IDLE NOISE

TX	70 kHz		534 kHz		1248 kHz	
	NPR /BINR Total/Idle	dBrnc0 Total/Idle	NPR /BINR Total/Idle	dBrnc0 Total/Idle	NPR /BINR Total/Idle	dBrnc0 Total/Idle
A	-57/-61	15.3/11.3	-56/-61	16.3/11.3	-58/-62	14.3/10.3
B	-57/-61	15.3/11.3	-57/-61	15.3/11.3	-58/-62	14.3/10.3

FACTORY READINGS (POWER CONNECTION PANEL)

	DIGITAL METER	PANEL METER
-20v A	20 VOLT	-20 VOLT
-23v A	20 VOLT	— VOLT
-20v B	20 VOLT	-20 VOLT
-23v B	20 VOLT	— VOLT

PLT FREQ 1974.99 kHz (Measured)

PLT OSC MON -40.2 dBm

PLT OSC TP OSC ON 92 μA*

OSC OFF 2 μA*

*READ ON EXT PANEL METER WITH TEST CORD PROVIDED IN OPERATING SPARES KIT

Farinon

FL1-2 **SYSTEM TEST DATA**

MESSAGE TYPE SYSTEM A

Date: 7/8/80

System Freq. 1905.0 MHz

Local Osc. Freq. 1835.0 MHz

Baseband Freq. .3 - 1300 kHz

Deviation 280 kHz rms per ch.

Bessel Zero -0.4 dBmO AT 100kHz 4.3 i/ no preemphasis

RCVR Wiring List No. 79750-C2

Coordinating TX Wiring List No. 79750-F

Transmitter Input Level -25 dBm(Test-Tone)

Receiver Output Level -25 dBm(Test-Tone)

Pilot Freq. 1975.0 kHz

BASEBAND FREQUENCY RESPONSE (Reference to 100 kHz)

Test Frequency (kHz)	.3	1	4	10	60	100	200	500	1M	1.3M		
Response (dB)	-.6	-.2	-.1	-.05	Ø	Ø	+.05	+.1	-.05	-.1		

NOISE DATA RECORDINGS

NOISE LOADING +9.8 dBmO White Noise Load

RF Signal Input dBm	70 kHz		534 kHz		1248 kHz	
	NPR /BINR Total/Idle	dBrncO Total/Idle	NPR /BINR Total/Idle	dBrncO Total/Idle	NPR /BINR Total/Idle	dBrncO Total/Idle
-36.5	-56.5/-61	15.8/11.3	-56/-60	16.3/12.3	-57.5/-60	14.8/12.8

Farinon

FL1-2 **TRANSMITTER TEST DATA**

TYPE TX A

OPERATING FREQUENCY 1985.0 MHz WIRING LIST NO. 79750-C2

LOCAL OSC. FREQUENCY 2055.0 MHz

FACTORY RECORDINGS

POWER OUTPUT (AT ANTENNA PORT) 29.5 dBm

XMTR FREQ. (AFC 'ON') 1985.0 MHz

DEVN MARGINS + 4.5 dB − 4.9 dB

METER READINGS

POWER OUTPUT 0.5 dB, OdB = + 29 dBm
(REFERENCED AT ANTENNA PORT)

L.O. XTAL 93409.1 kHz

AFC OFFSET ∅ kHz

A.F.C. DISC (BLUE) 50 = ∅ = center µA*

VOLT (YELLOW) 49 center scale µA*

PD (GREEN) 2 µA*

IF LEV (RED) 54 µA*

L.O. TP1 10 µA*

1 WATT PWR AMP PWR MON +10.9 dBm

5 WATT PWR AMP PWR MON N/A dBm

PWR AMP (OUTPUT AT CIRCULATOR)

1 WATT +30.9 dBm

5 WATT a/A dBm

ANTENNA COUPLING LOSS 1.4 dB

* READ ON EXT PANEL METER WITH TEST CORD PROVIDED IN OPERATING SPARES KIT

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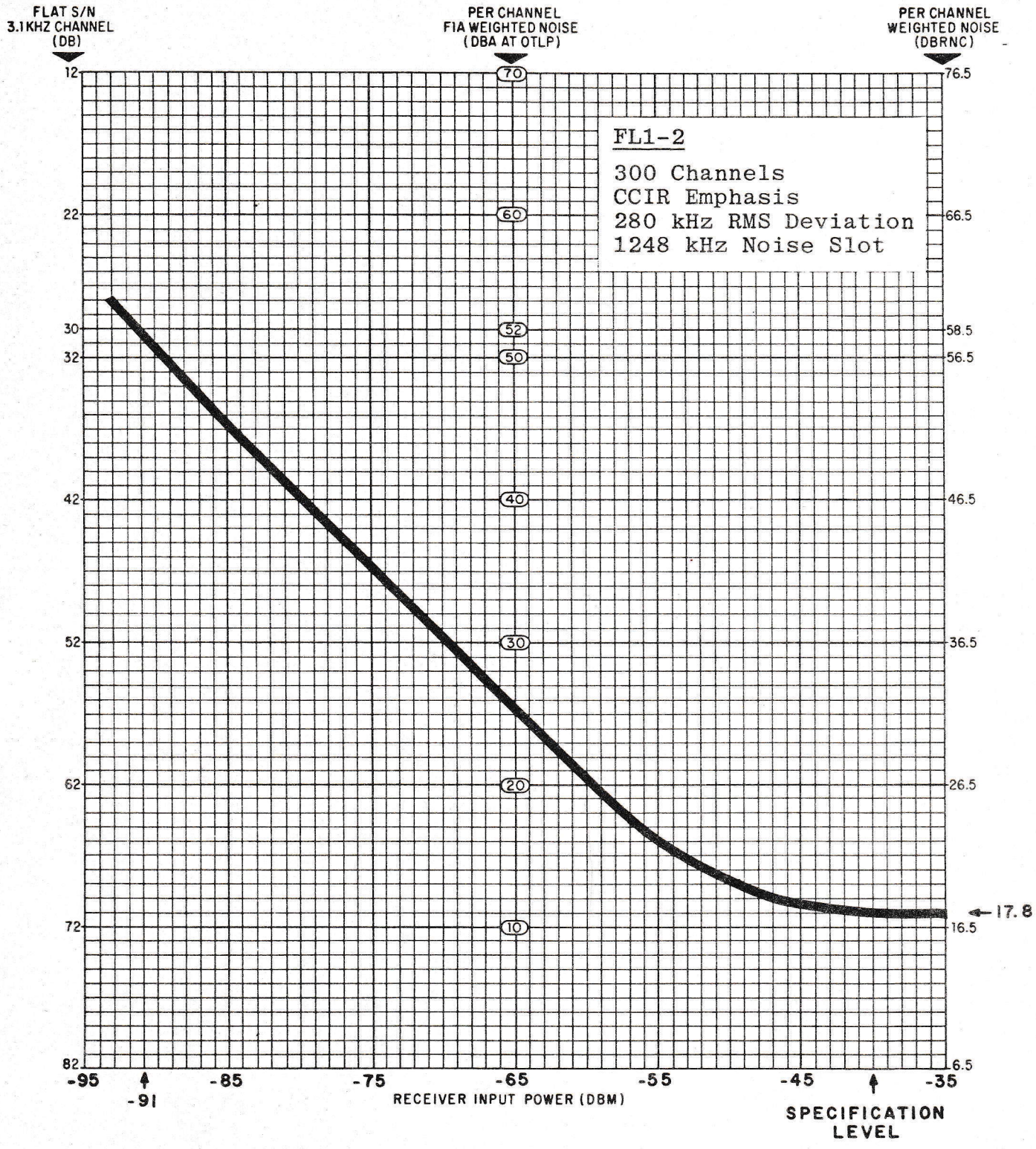
FLAT S/N
3.1KHZ CHANNEL
(DB)
PER CHANNEL
F1A WEIGHTED NOISE
(DBA AT OTLP)
PER CHANNEL
WEIGHTED NOISE
(DBRNC)
FL1-2
300 Channels
CCIR Emphasis
280 kHz RMS Deviation
1248 kHz Noise Slot
12
22
30
32
42
52
62
72
82
70
60
52
50
40
30
20
10
76.5
66.5
58.5
56.5
46.5
36.5
26.5
16.5
6.5
17.8
-95
-91
-85
-75
-65
-55
-45
-35
RECEIVER INPUT POWER (DBM)
SPECIFICATION
LEVEL

NOISE LOADING TEST DATA

300 CHANNELS

WIDEBAND NOISE LOADING LEVEL:		+9.8 dBm0
NOISE SLOT POSITIONS	LOW SLOT	70 kHz
	MID SLOT	534 kHz
	TOP SLOT	1248 kHz
BANDWIDTH SELECT FILTERS	HIGH PASS	60 kHz
	LOW PASS	1296 kHz
LOADED NOISE MEASUREMENT	Equal to or less than 17.8 dBrnc0 for an RF input level of -40 dBm.	
IDLE NOISE REQUIREMENT:	See graph to the left.	
AGC vs. RF INPUT GRAPH:	See Factory Test Record.	

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FL1-2 **RECEIVER TEST DATA**

MESSAGE TYPE RCVR A

Operating Frequency 1905.0 MHz Wiring List No. 79750-C2

Local Oscillator Oper. Freq. 1835.0 MHz L.O. Xtal 91.7500 MHz

SERIAL NO. _____

BASEBAND MARGINS + 10.4 dB − 2 dB BASEBAND CALIB. −39.5 flat meter dB

100KHz @ −.4 dBmO

FACTORY READINGS

MIXER TEST POINT 32 µA*

DISC. ZERO DEMOD Ø µA*

L.O. TP1 9 µA*

*READ ON EXT PNL METER WITH TEST CORD PROVIDED IN OPERATING SPARES KIT.

HYBRID	CPLR	SD/NP
✓		

RECEIVER SENSITIVITY

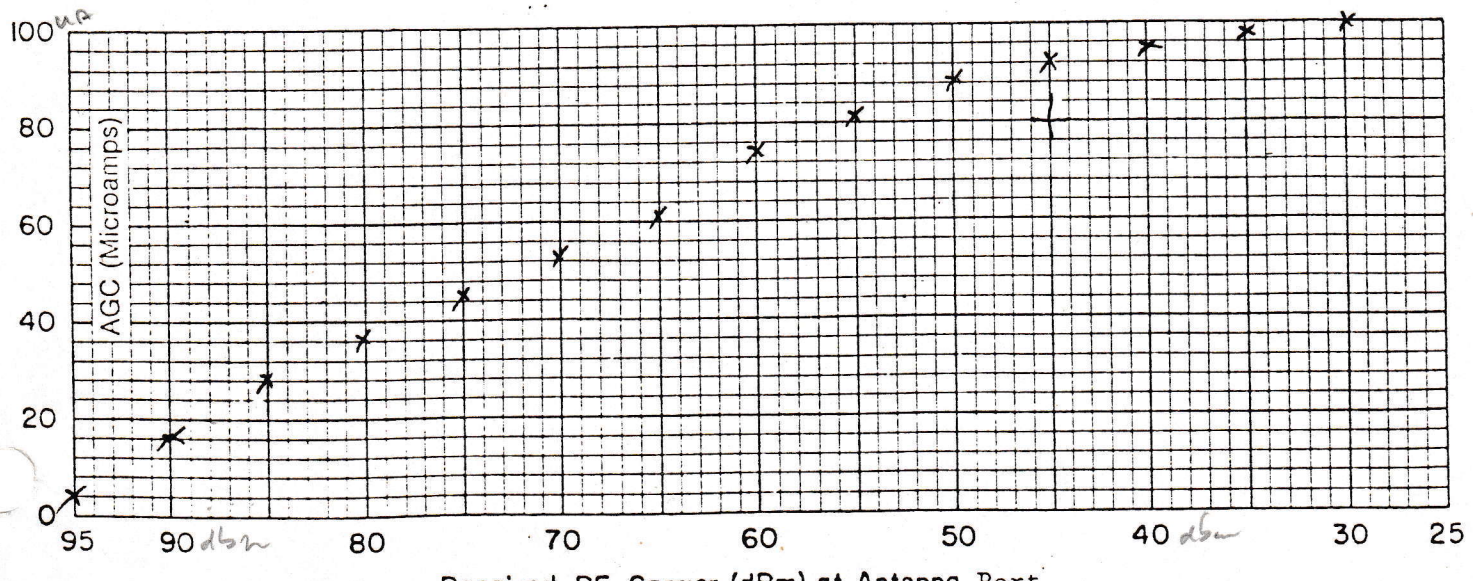
(ALL MEASRUEMENTS REFERED TO ANTENNA PORT)

RF Signal (dBm) AT Ant. W/G Flange	−30	35	40	50	60	65	70	75	80	−90	
NPR (1248 kHz)	-66.3	-65.3	-62.8	-54.3	-44.3	-40.3	-35.3	-29.8	-24.8	-13.8	
dBrncO	6	7	9.5	18	28	32	37	42.5	47.5	58.5	

Receiver Threshold Ext. −65 dBm RF Signal (Yellow LED)

Receiver Nodan Alm. (58.5 dBrmCO) −90 dBm RF Signal (Red LED)

RECEIVER AGC CURVE



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FL1-2 **SYSTEM TEST DATA**

MESSAGE TYPE SYSTEM B

Date: 7/8/80

System Freq. 1905.0 MHz

Local Osc. Freq. 1835.0 MHz

Baseband Freq. .3 - 1300 kHz

Deviation 280 kHz rms per ch.

Bessel Zero -0.4 dBmO AT 100kHz

RCVR Wiring List No. 79750-C2

Coordinating TX Wiring List No. 79750-F

Transmitter Input Level -25 dBm(Test-Tone)

Receiver Output Level -25 dBm(Test-Tone)

Pilot Freq. 1975.0 kHz

BASEBAND FREQUENCY RESPONSE (Reference to 100kHz)

Test Frequency (kHz)	.3	1	4	10	60	100	200	500	1M	1.3M		
Response (dB)	-.55	-.1	-.05	-.05	0	0	+.05	+.15	0	-.15		

NOISE DATA RECORDINGS

NOISE LOADING +9.8 dBmO White Noise Load

RF Signal Input dBm	kHz		kHz		kHz	
	NPR /BINR Total/Idle	dBrncO Total/Idle	NPR /BINR Total/Idle	dBrncO Total/Idle	NPR /BINR Total/Idle	dBrncO Total/Idle
-36.5	-57/-61	15.3/11.3	-57/-60	15.3/12.3	-58/-61	14.3/11.3

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FL1-2 **TRANSMITTER TEST DATA**

TYPE TX B

OPERATING FREQUENCY 1985 MHz WIRING LIST NO. 79750C2

LOCAL OSC. FREQUENCY 2055 MHz

FACTORY RECORDINGS

POWER OUTPUT (AT ANTENNA PORT) 30.5 dBm

XMTR FREQ. (AFC 'ON') 1985.0 MHz

DEVN MARGINS + 3.0 dB − 6.4 dB

METER READINGS

POWER OUTPUT 1.5 dB, OdB = + 29 dBm
(REFERENCED AT ANTENNA PORT)

L.O. XTAL 99,409.1 kHz

AFC OFFSET Ø kHz

A.F.C.
DISC (BLUE) 50 µA*
VOLT (YELLOW) 49 µA*
PD (GREEN) 2 µA*
IF LEV (RED) 58 µA*

1 WATT PWR AMP PWR MON +11.6 dBm

5 WATT PWR AMP PWR MON N/A dBm

L.O.
TP1 10 µA*

PWR AMP (OUTPUT AT CIRCULATOR)
1 WATT 31.5 dBm
5 WATT N/A dBm

ANTENNA COUPLING LOSS 1 dB

* READ ON EXT PANEL METER WITH TEST CORD PROVIDED IN OPERATING SPARES KIT

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FL1-2 **RECEIVER TEST DATA**

MESSAGE TYPE RCVR B

Operating Frequency 1905.0 MHz Wiring List No. 79750C2

Local Oscillator Oper. Freq. 1835.0 MHz L.O. Xtal 91.7500 MHz
SERIAL NO. _____

BASEBAND MARGINS + 10.1 dB − 2.2 dB BASEBAND CALIB. 39.5 dB

FACTORY READINGS

MIXER TEST POINT 30 µA*

DISC. ZERO DEMOD 0 µA*

L.O. TP1 9 µA*

*READ ON EXT PNL METER WITH TEST CORD PROVIDED IN OPERATING SPARES KIT.

HYBRID	CPLR	SD/NP
✓		

RECEIVER SENSITIVITY (ALL MEASRUEMENTS REFERED TO ANTENNA PORT)

RF Signal (dBm) AT Ant. W/G Flange	30	35	40	50	60	65	70	75	80	90	
NPR (248 kHz)	-66.3	-65.3	-63.3	-54.8	-54.8	-40.3	-35.8	-30.3	-25.8	-13.8	
dBrncO	6	7	9	17.5	27.5	32	36.5	42	46.5	58.5	

Receiver Threshold Ext. −65 dBm RF Signal (Yellow LED)

Receiver Nodan Alm. (58.5 dBrmCO) −90 dBm RF Signal (Red LED)

RECEIVER AGC CURVE

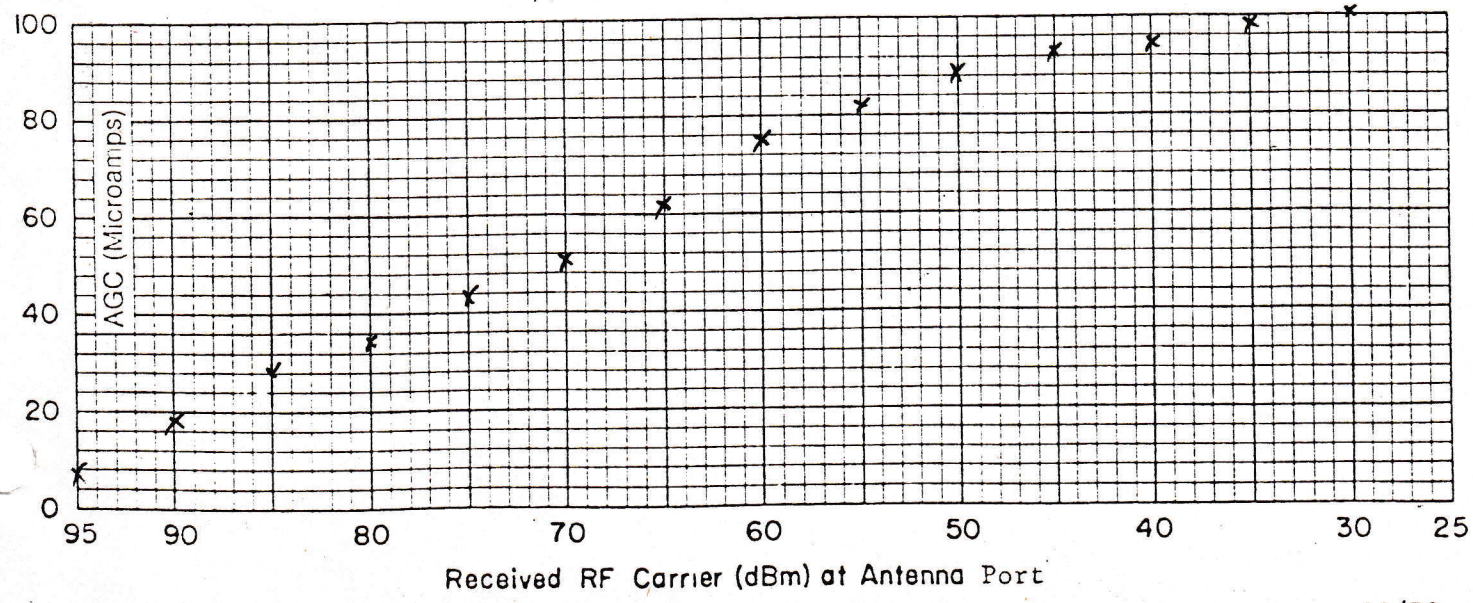

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FIG 1
DC DISTRIBUTION

MTD ON 'L' BRACKET
AT TOP RIGHT OF RACK

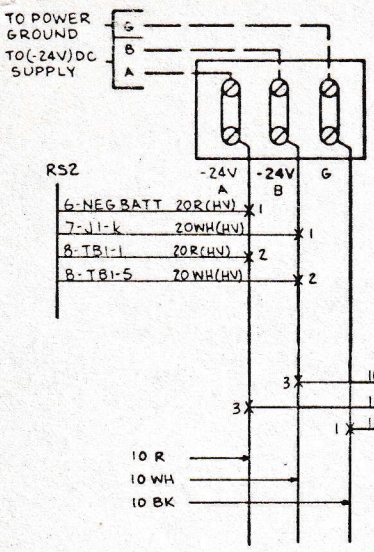


FIG 2
POWER CONNECTION PANEL
SD-101275

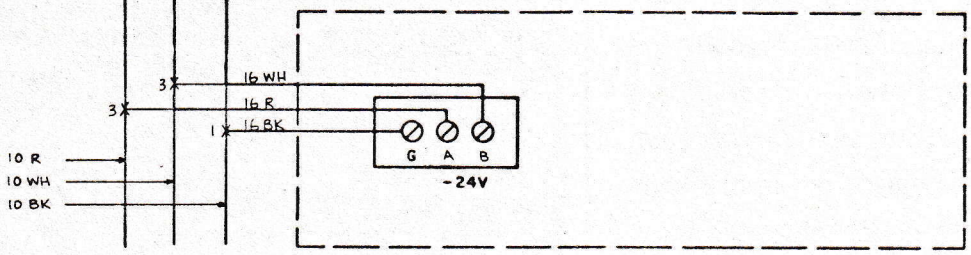
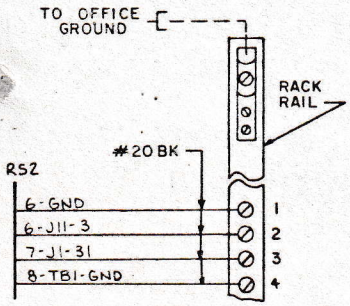


FIG 3
RACK GROUNDING



RCVR LOCK ALM CO
SET XMTR A O
SET RCVR A O
XMTR LOCK ALM N
XMTR LOCK ALM CO

GN

RCVR LOCK ALM N

RCVR A AGC OU
XMTR A SUM ALM CO
XMTR A SUM ALM N

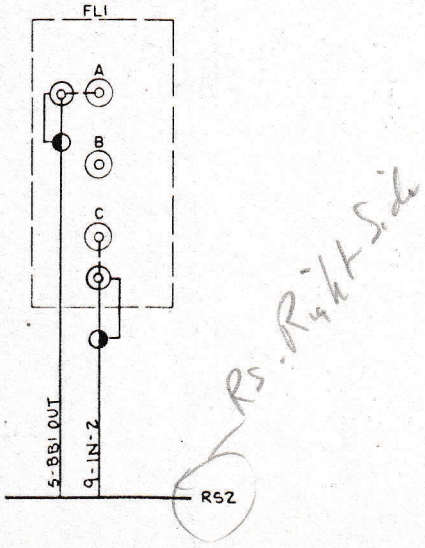
RCVR B AGC OU
XMTR B SUM ALM CO
XMTR B SUM ALM N
RCVR A SUM ALM CO
RCVR A SUM ALM N

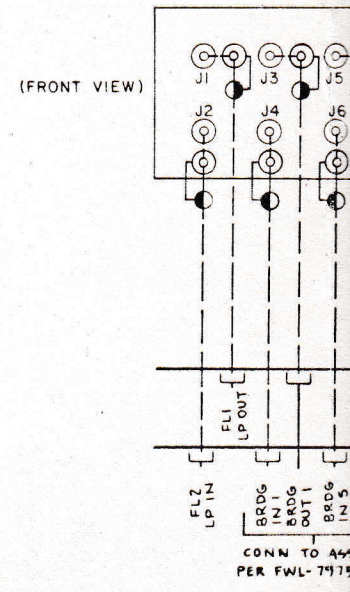
SET XMTR B C

RCVR B SUM ALM CO
RCVR B SUM ALM N

SET RCVR B O

RCVR RESE





EW-79750

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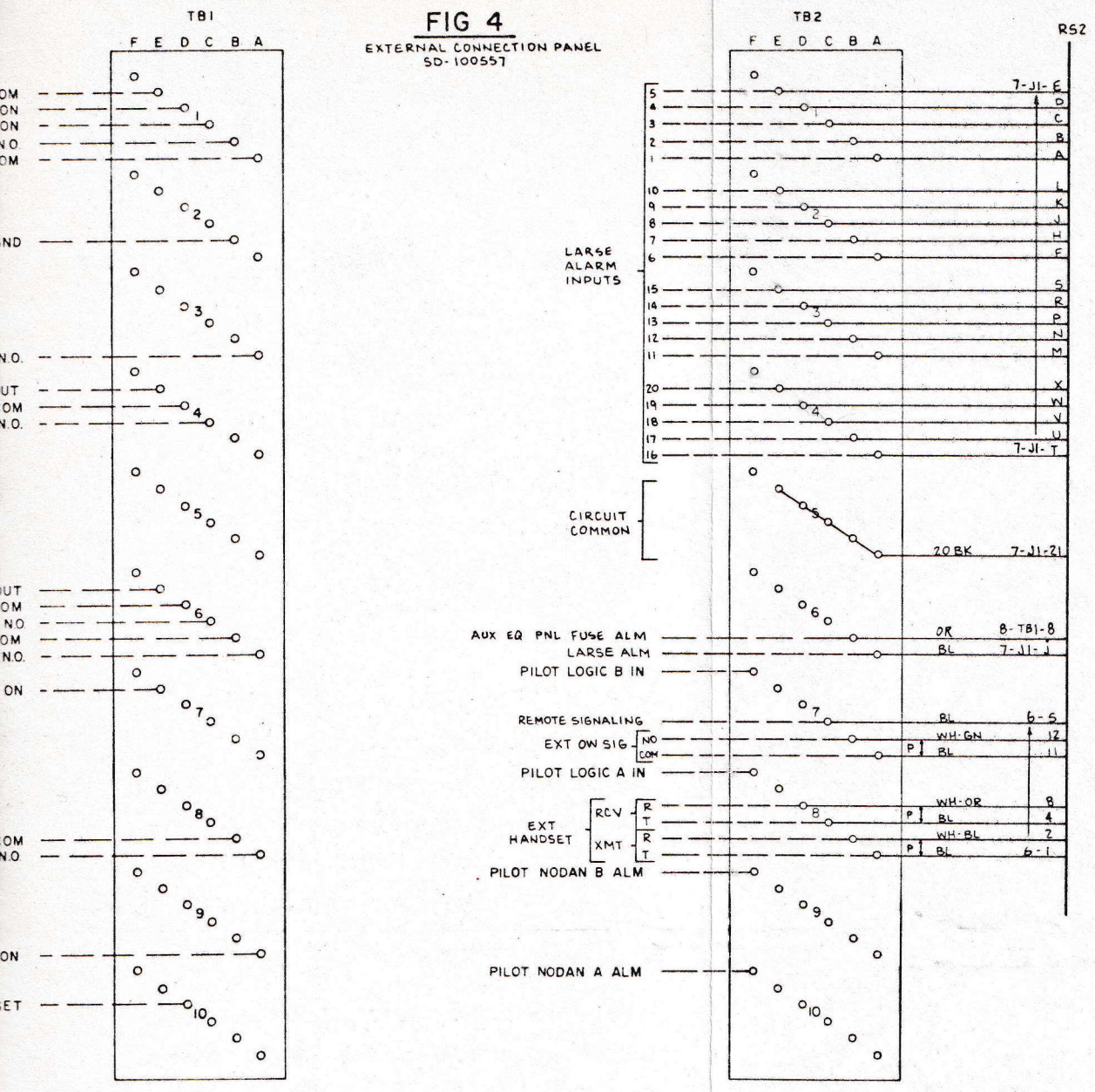
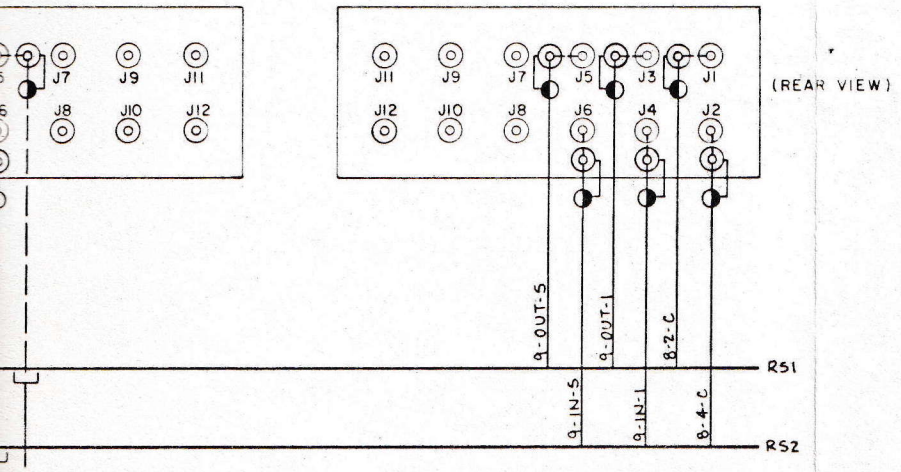
1	NG	1-11-80

FIG 4

EXTERNAL CONNECTION PANEL
SD-100557





[8] 2' SERVICE LOOP REQUIRED FOR THIS PANEL.

7 UNLESS OTHERWISE SPECIFIED, ALL STRAPPING ON, AND OR BETWEEN, TERMINAL BLOCKS IS TO BE ON THE CUSTOMER SIDE OF THE BLOCK(S).

6. INDICATES DOUBLE SHIELDED 75 Ω COAXIAL CABLE.

5. INDICATES TWO CONDUCTOR SHIELDED CABLE.

4 INDICATES SINGLE CONDUCTOR SHIELDED CABLE, RG174U.

3. P INDICATES PAIRED WIRES.

2. ---- INDICATES CUSTOMER WIRING OR CONNECTION.

1 LS DENOTES CABLE RUN ON LEFT SIDE OF THE RACK, AS VIEWED FROM THE REAR. RS DENOTES CABLE RUN ON THE RIGHT SIDE.

NOTES

CUSTOMER : NEB. PUBLIC PWR DIST.

LOCATION : EAST NORFOLK

SCALE ——	ENGR BY NG	APP'D YT	
DATE 4-8-80	DRAWN BY BUGHI	APP'D RK	

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EQUIPMENT WIRING

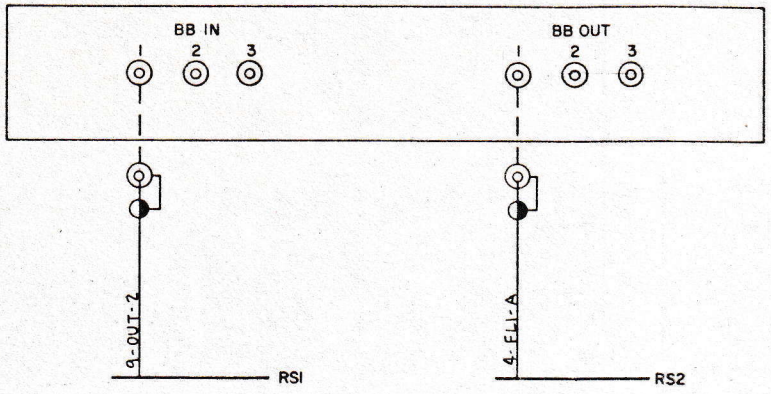
FLI-2 MHS RADIO ASS'Y

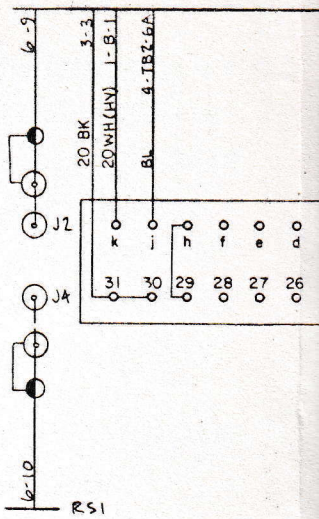
SHEET 1 OF 2 SHEETS

EW-79750 C2 D

FIG 5

BB INTERFACE PANEL
SD-83217 (FRONT VIEW) [8]





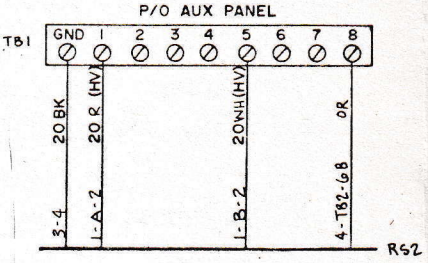
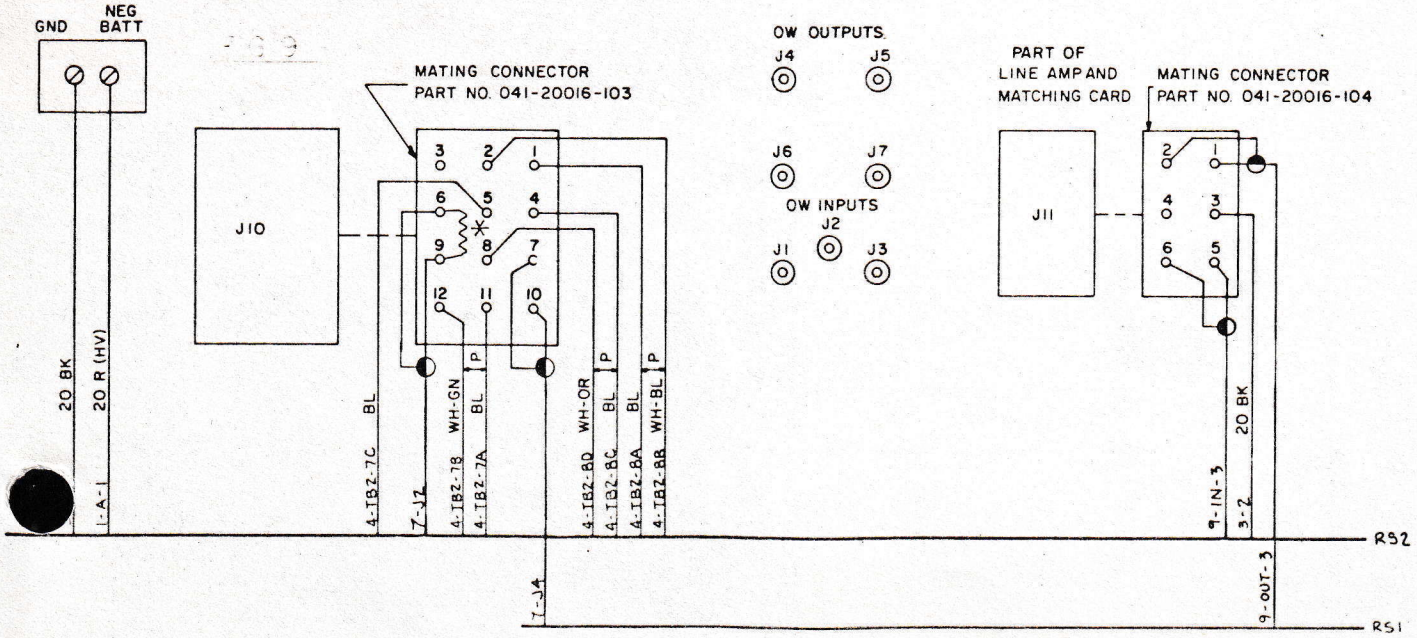


FIG 6

ORDERWIRE SHELF
SD-19379 M2-80907 (REAR VIEW)

* 604 Ω. 1/8 W 1% RESISTOR



EW-79750		
REVISIONS		
ISSUE	APPROVED	DATE
1	NG	7-11-80

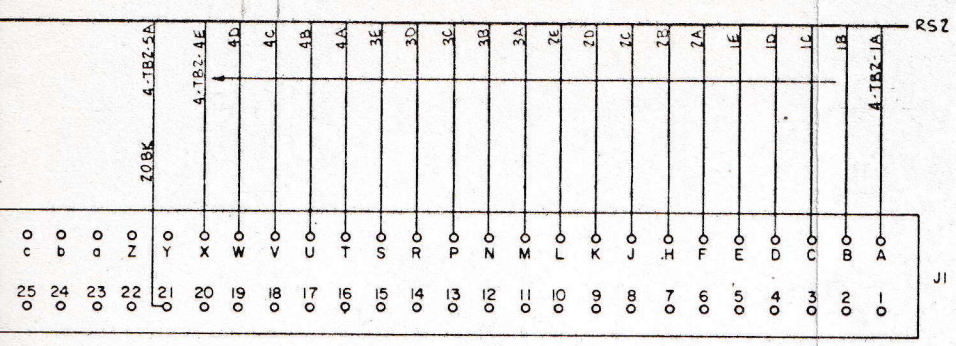
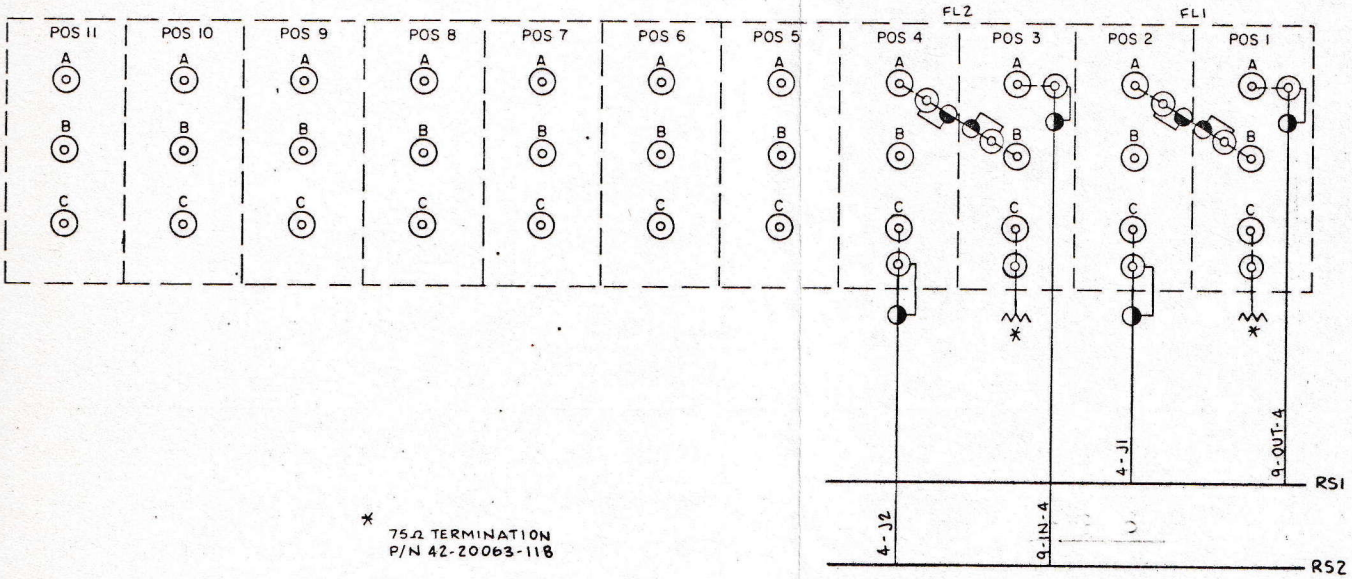


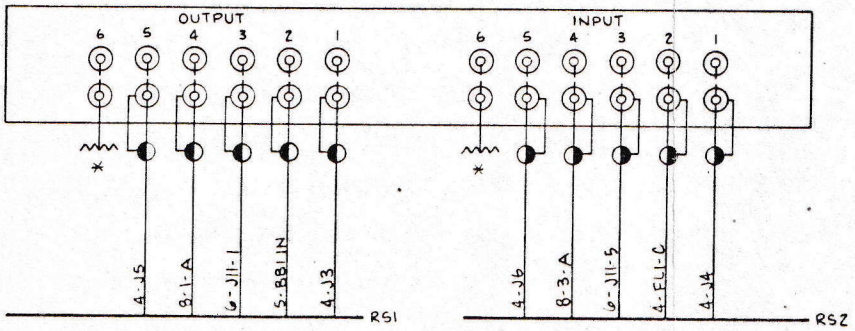
FIG 7
LARSE REMOTE ALARM
8320 B-701

FIG 8
SD-19950 AUXILLARY PNL
(REAR VIEW)



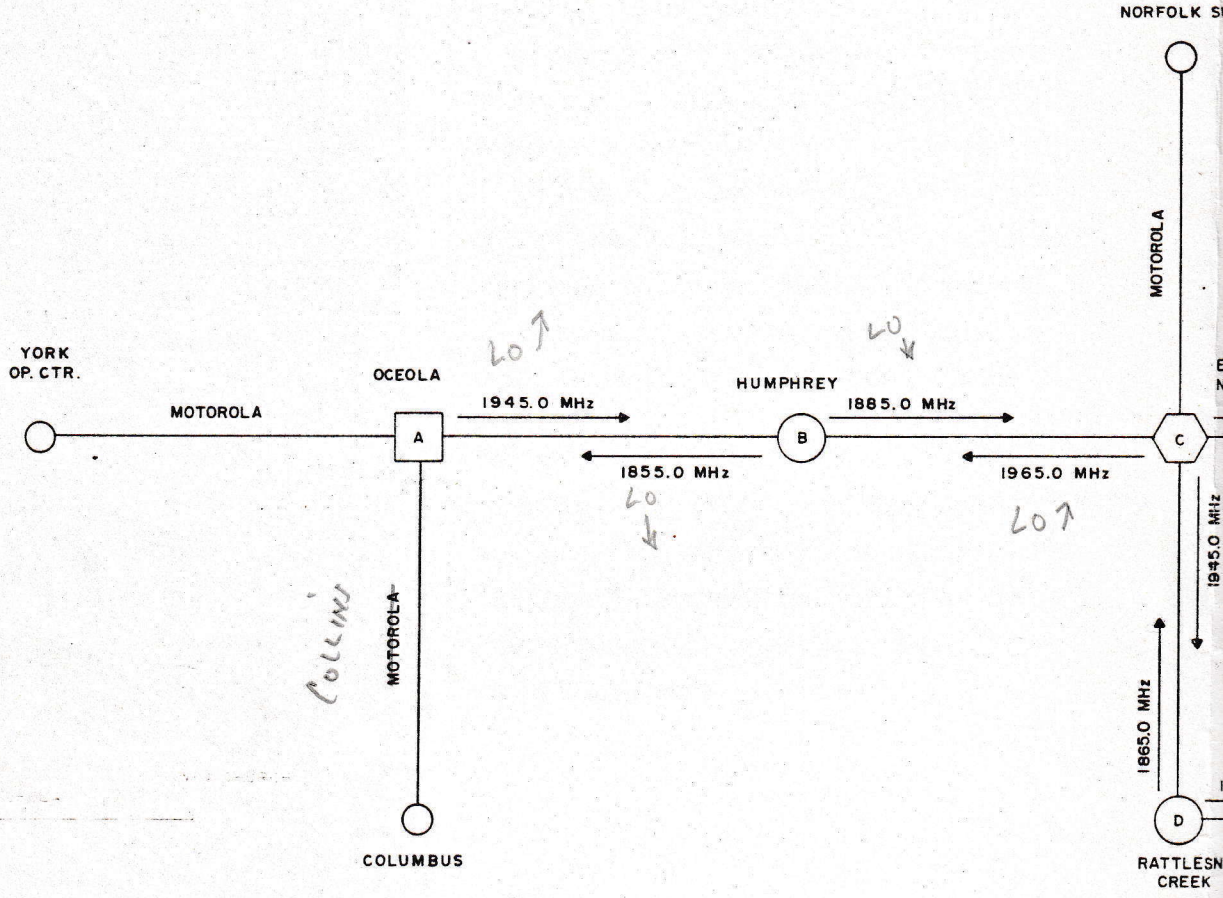
* 75Ω TERMINATION
P/N 42-20063-118

FIG 9
DANTEL 6W/4W BRDG 90002
(REAR VIEW)



CUSTOMER: NEB PUBLIC PWR DIST

SCALE		ENGR BY NG	APP'VD YT
DATE 4-8-80		DRAWN BY BUGHI	APP'VD RK
Farinon			
EQUIPMENT WIRING			
FLI-2 MHS RADIO ASS'Y			
		SHEET 2 OF 2 SHEETS	DWG SIZE
EW-79750 C2			D

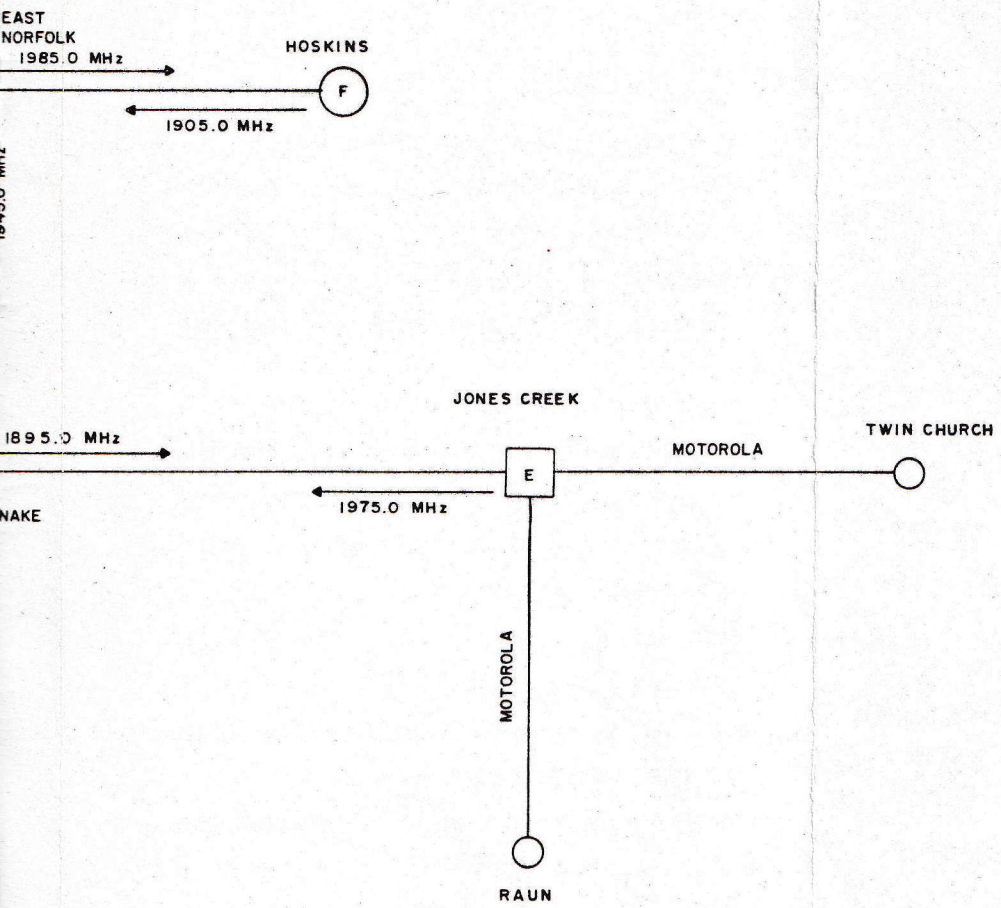

NORFOLK S
MOTOROLA
YORK
OP. CTR.
MOTOROLA
OCEOLA
A
1945.0 MHz
1855.0 MHz
HUMPHREY
B
1885.0 MHz
1965.0 MHz
C
1935.0 MHz
1865.0 MHz
D
RATTLESN
CREEK
COLLINS
MOTOROLA
COLUMBUS

SL-79750

SL-79750

REVISIONS		
ISSUE	APPROVED	DATE

SUB



CUSTOMER: NEB. PUB. POWER DIST.

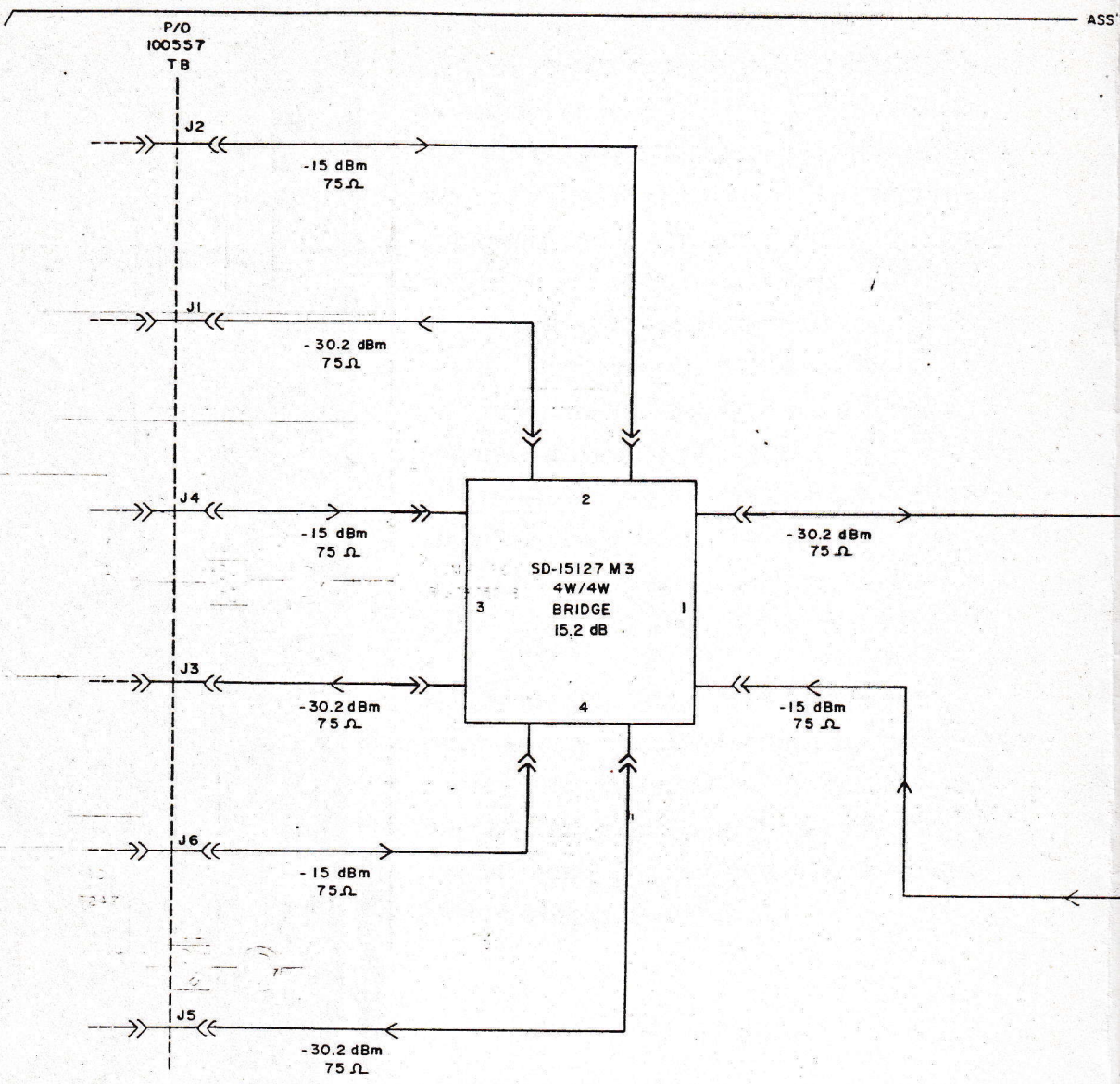
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:	
2 PLACE DECIMALS ± .015" / 3 PLACE DECIMALS ± .005" / FRACTIONAL DIMENSIONS ± 1/64"	ANGULAR DIMENSIONS ± 1° / HOLES UNDER .250 DIA. ± .005"
MATERIAL:	
FINISH:	
PROCESS:	
USED ON:	

SCALE		ENGR BY NG	APP'VD YTT
DATE 4-17-80		DRAWN BY LIZ	APP'VD. RK

Farinon

SYSTEM LAYOUT

ORIG. CUST.	SHEET 1 OF 1 SHEETS	DWG SIZE
SL-79750		D



2. ____INDICATES CUSTOMER WIRING OR CONNECTION.

1. LEVELS SHOWN ARE NOMINAL TEST TONE LEVELS AND MAY VARY ±0.5 dB FROM THESE VALUES.

NOTES:

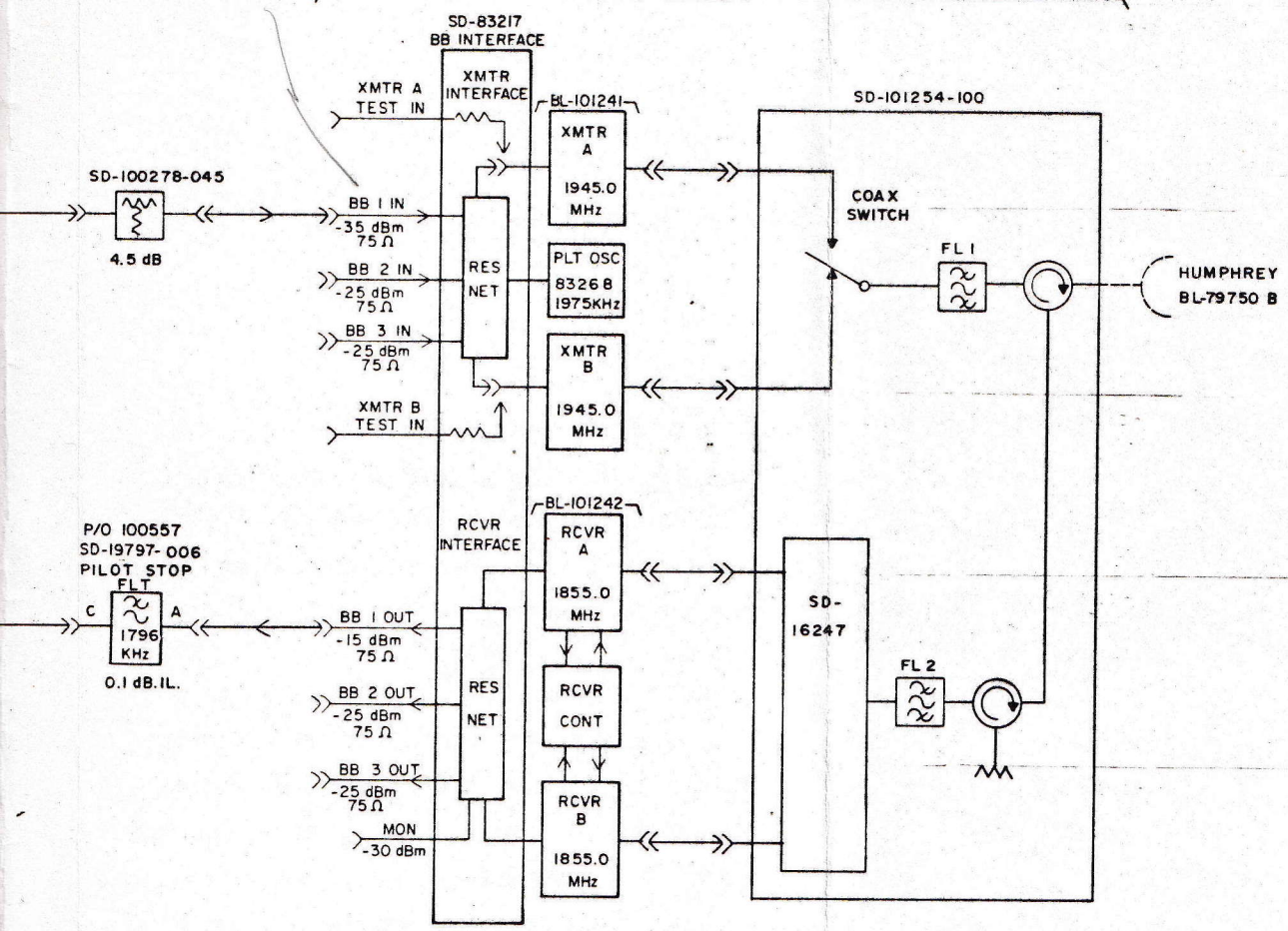
BL-79750A

BL-79750 A

REVISIONS		
ISSUE	APPROVED	DATE

S'Y PER FWL-79750 A

B, B # 1 must be Term. if not used.



CUSTOMER: NEB. PUBLIC POWER DIST

LOCATION: OSCEOLA

		DRAWN BY NG	APPROVED YTT
		DATE 4-18-80	DRAWN BY LIZ	APPROVED RK

Farinon

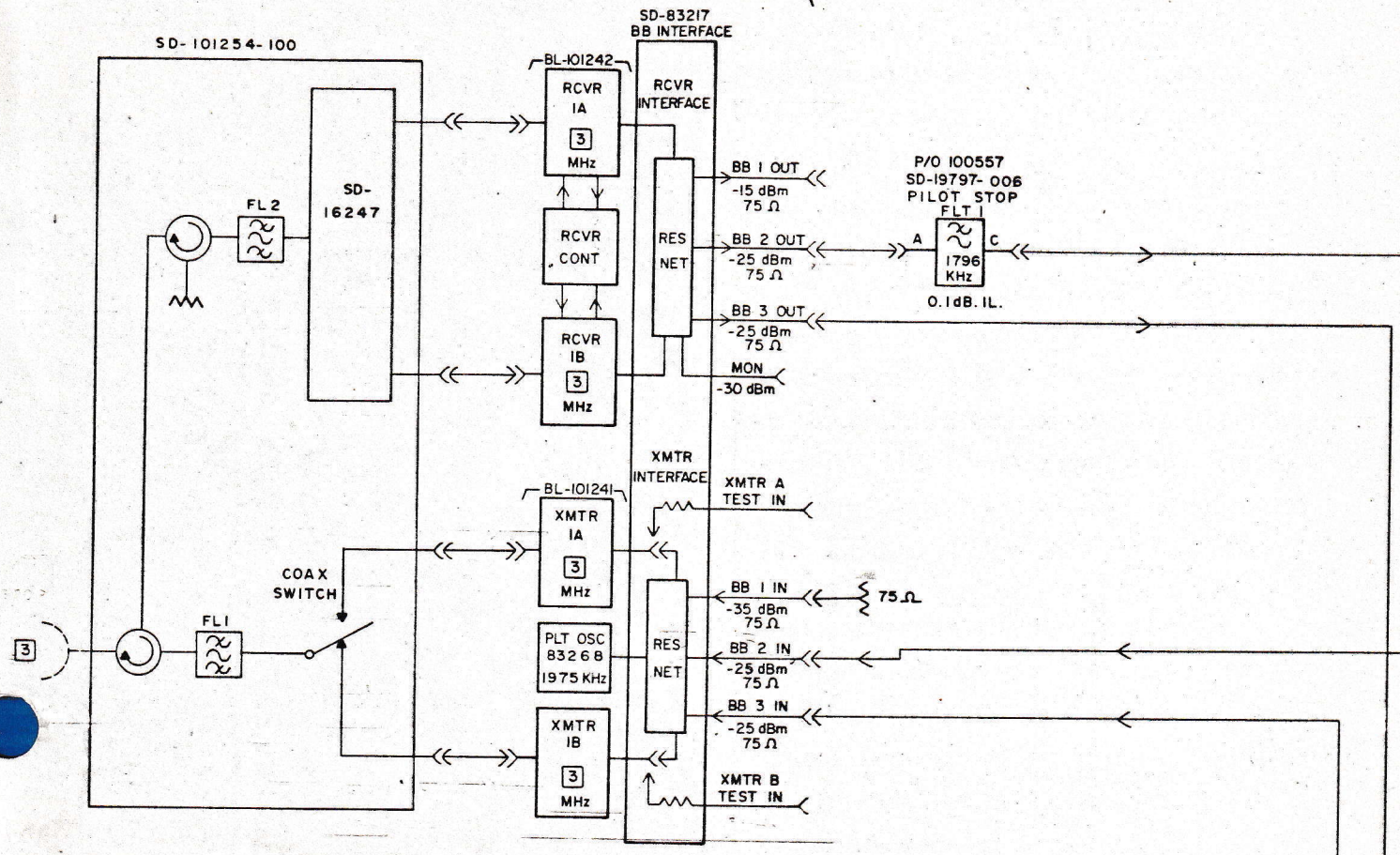
BLOCK & LEVEL DIAGRAM
FL1-2 MHS RADIO ASS'Y

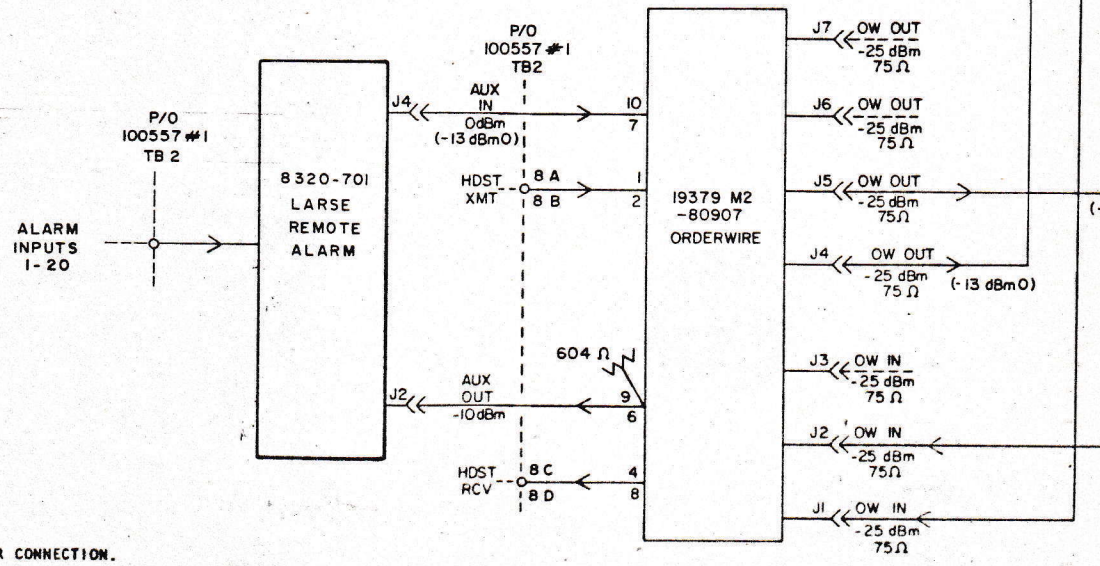
SCALE		SHEET 1 OF 1 SHEETS	DWG 8/78
DATE			

BL-79750 A D

IV

FL 1-2 BL-101270





3 SEE TABLE A.

2. _____ INDICATES CUSTOMER WIRING OR CONNECTION.

1. LEVELS SHOWN ARE NOMINAL TEST TONE LEVELS AND MAY VARY ±0.5 dB FROM THESE VALUES.

NOTES:

BL-79750

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ISSUE	APPROVED	DATE

PER FWL- 79750 B/D

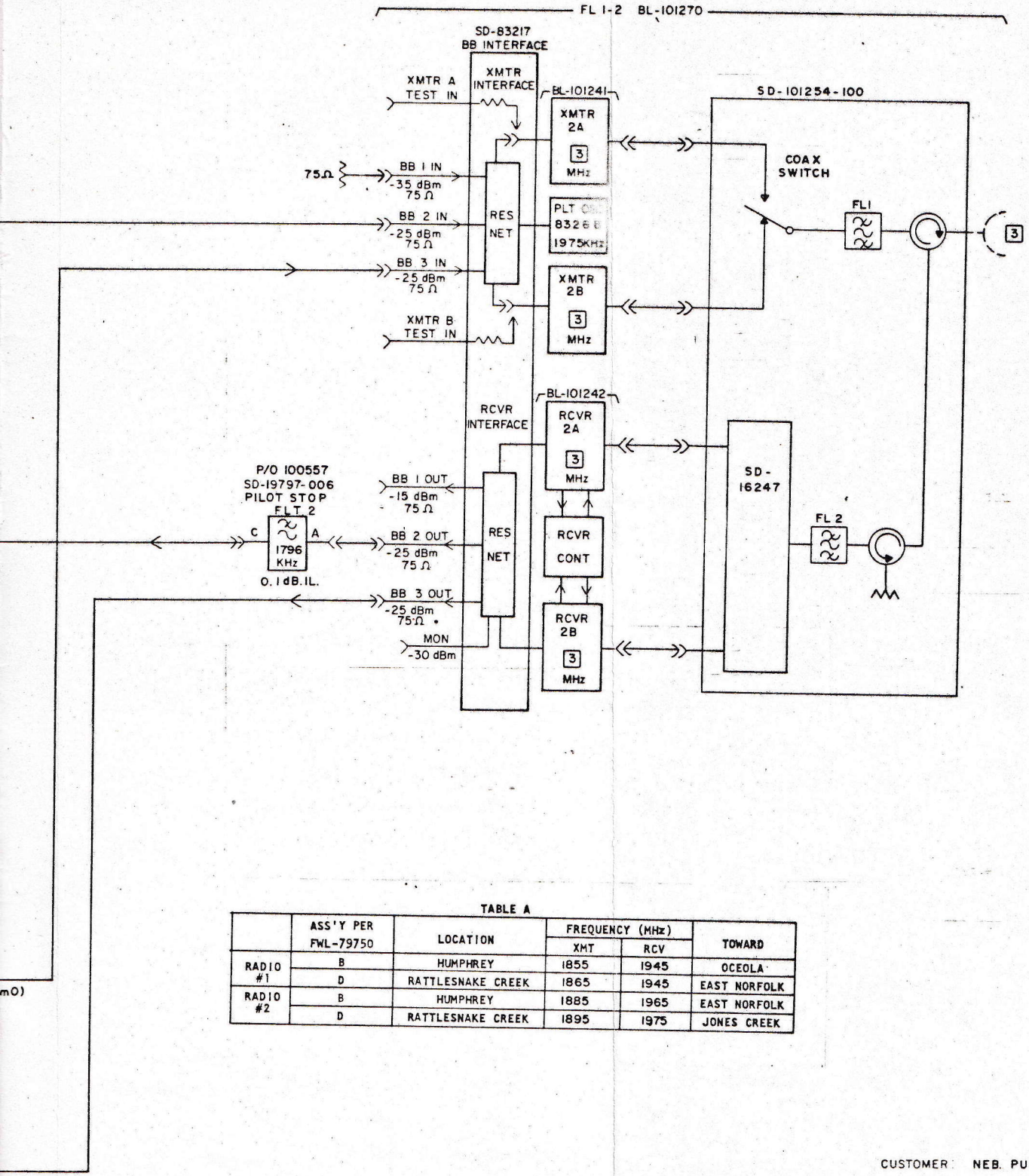


TABLE A

	ASS'Y PER FWL-79750	LOCATION	FREQUENCY (MHz)		TOWARD
			XMT	RCV	
RADIO #1	B	HUMPHREY	1855	1945	OCEOLA
	D	RATTLESNAKE CREEK	1865	1945	EAST NORFOLK
RADIO #2	B	HUMPHREY	1885	1965	EAST NORFOLK
	D	RATTLESNAKE CREEK	1895	1975	JONES CREEK

CUSTOMER: NEB. PUBLIC POWER DIST.

LOCATION: B- HUMPHREY
D- RATTLESNAKE CREEK

DRAWN BY	NG	APPROVED	YTT
DATE 4-18-80	CHKD BY LIZ	APPROVED	RK

Farinon

BLOCK & LEVEL DIAGRAM
FL 1-2 MHS RADIO ASS'Y

SHEET 1 OF 1 SHEETS

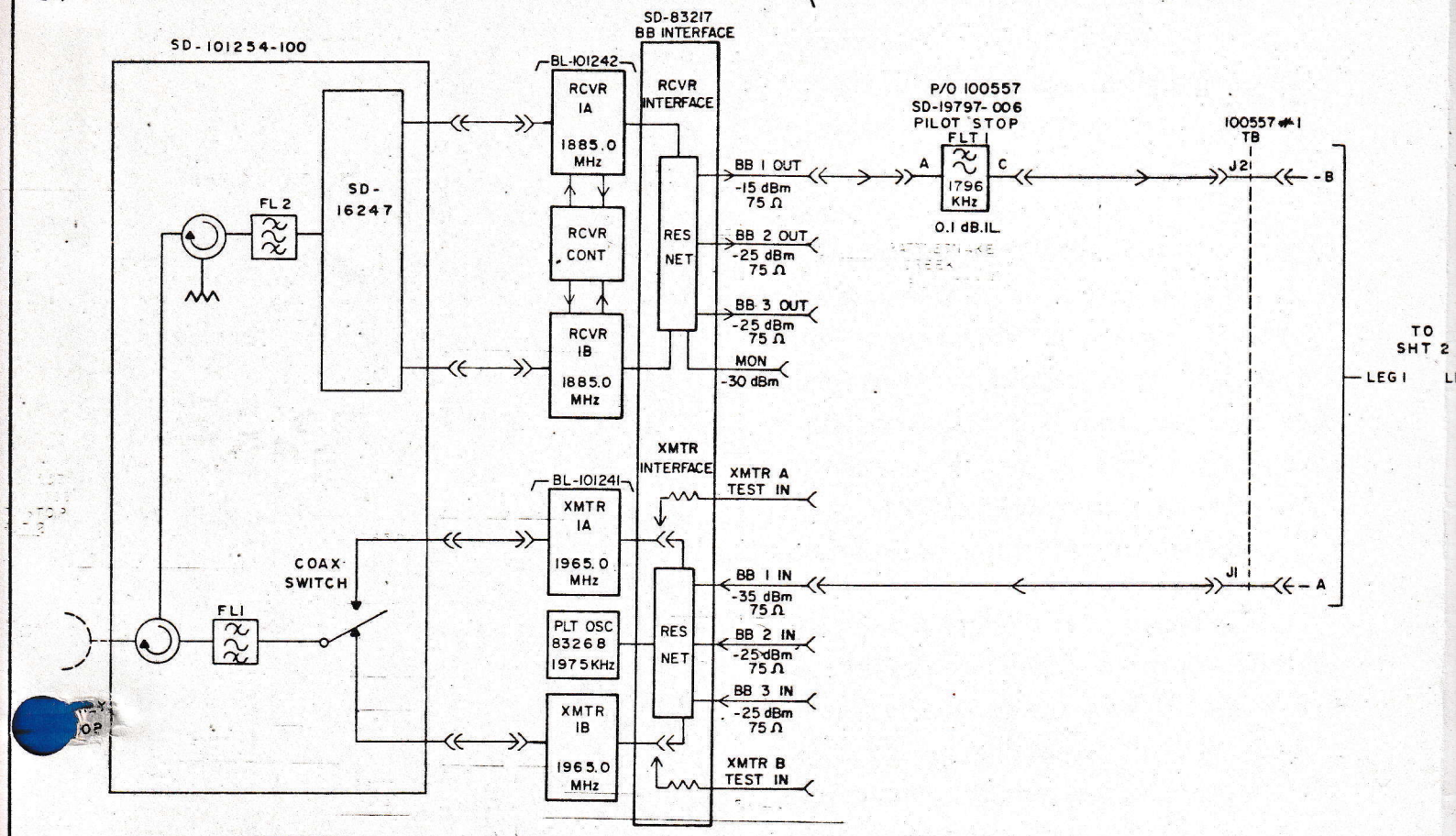
BL-79750 B,D

D

,D

P/O ASS'Y PER FWL-79750 C1

FL 1-2 BL-101270



2. _____INDICATES CUSTOMER WIRING OR CONNECTION.

1. LEVELS SHOWN ARE NOMINAL TEST TONE LEVELS AND MAY VARY ±0.5 dB FROM THESE VALUES.

NOTES:

BL-79750C

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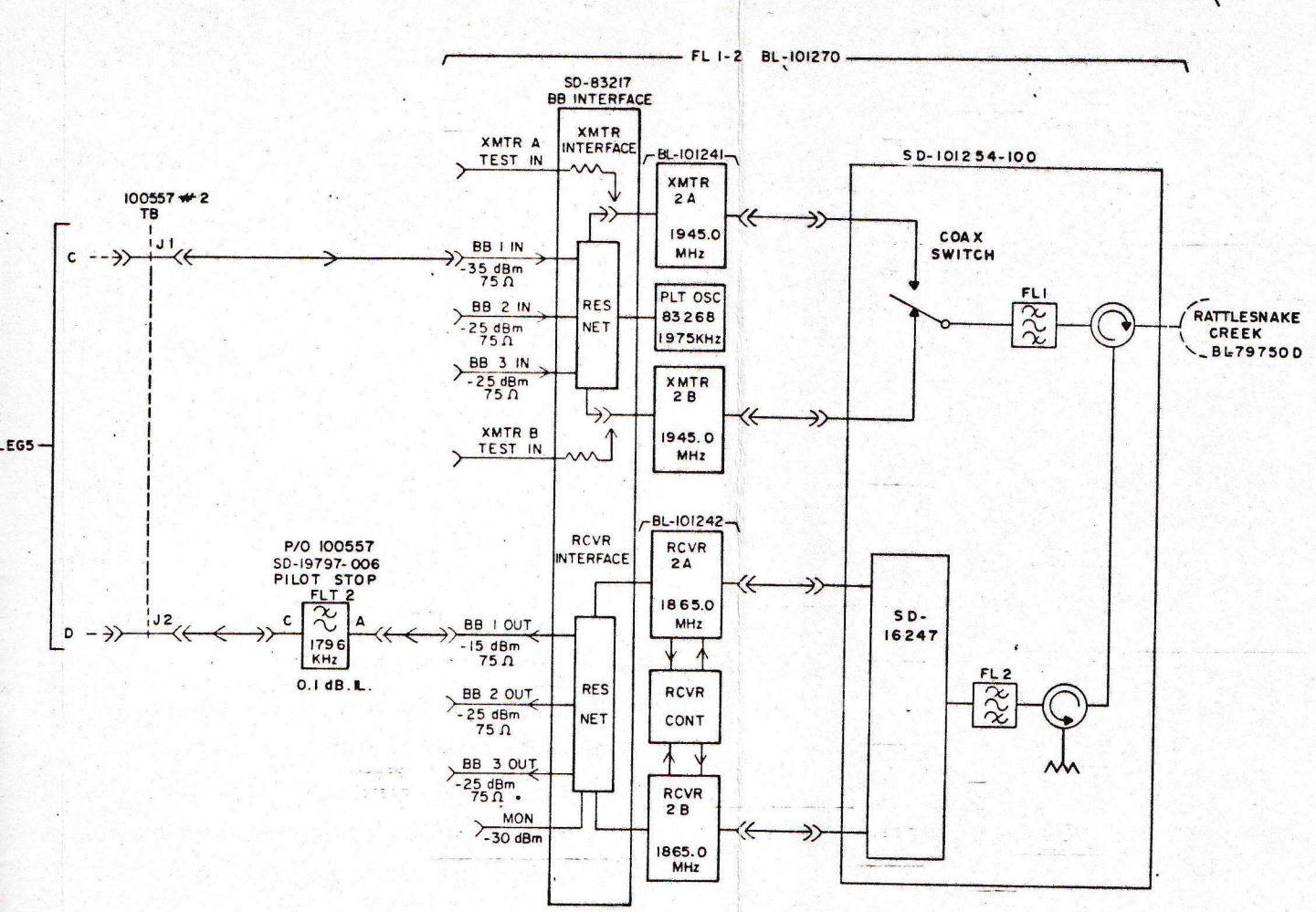
ISSUE	APPROVED	DATE



CUSTOMER: NEB. PUBLIC POWER DIST.

LOCATION: EAST NORFOLK

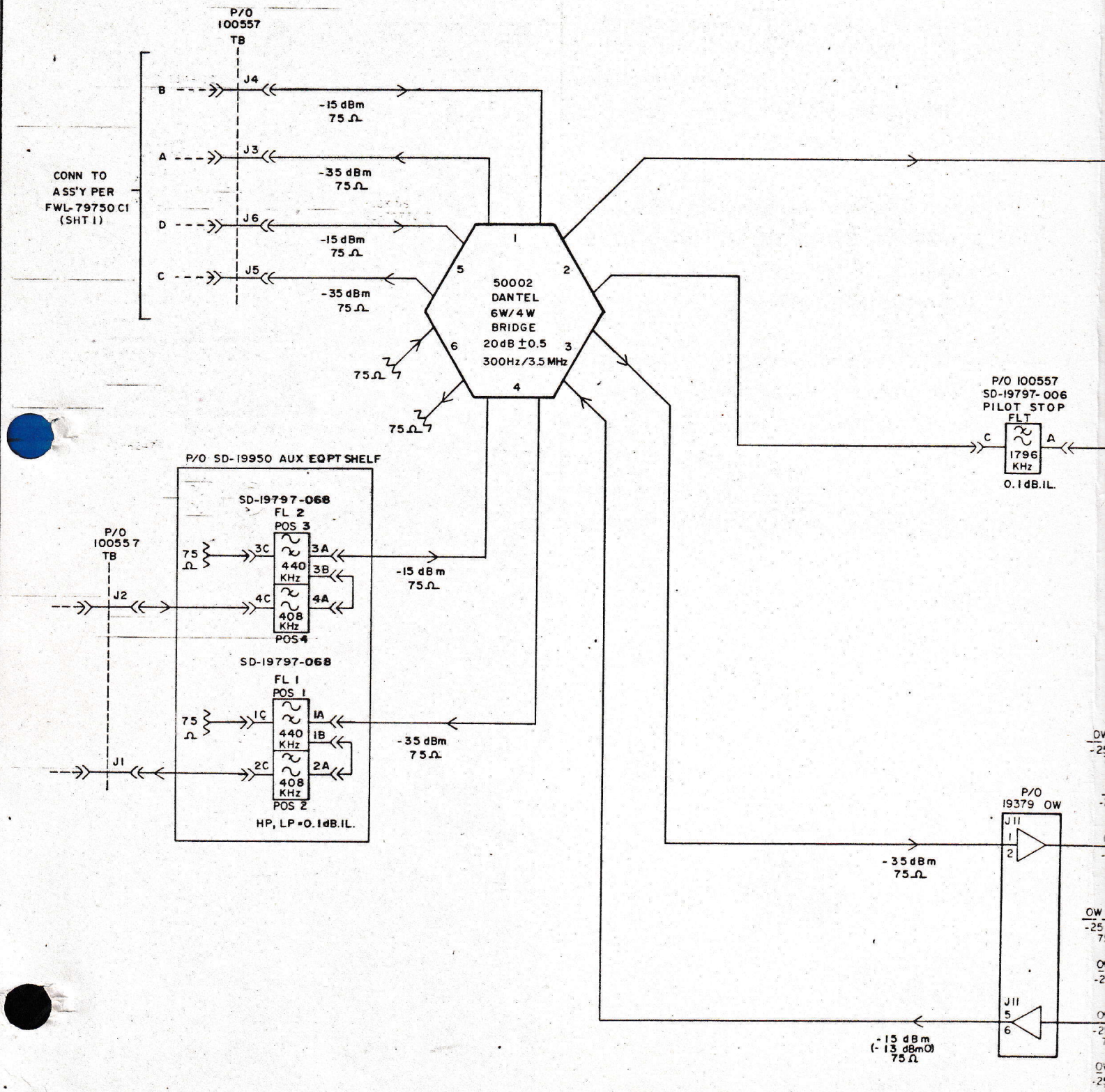
SCALE		ENGR BY	NG
DATE	4-18-80	DRAWN BY	LIZ
APPD		APPD	YTT
APPD		APPD	RK

Farinon

BLOCK & LEVEL DIAGRAM
FLI-2 MHS RADIO ASS'Y

SHEET 1 OF 2 SHEETS

BL-79750 C D

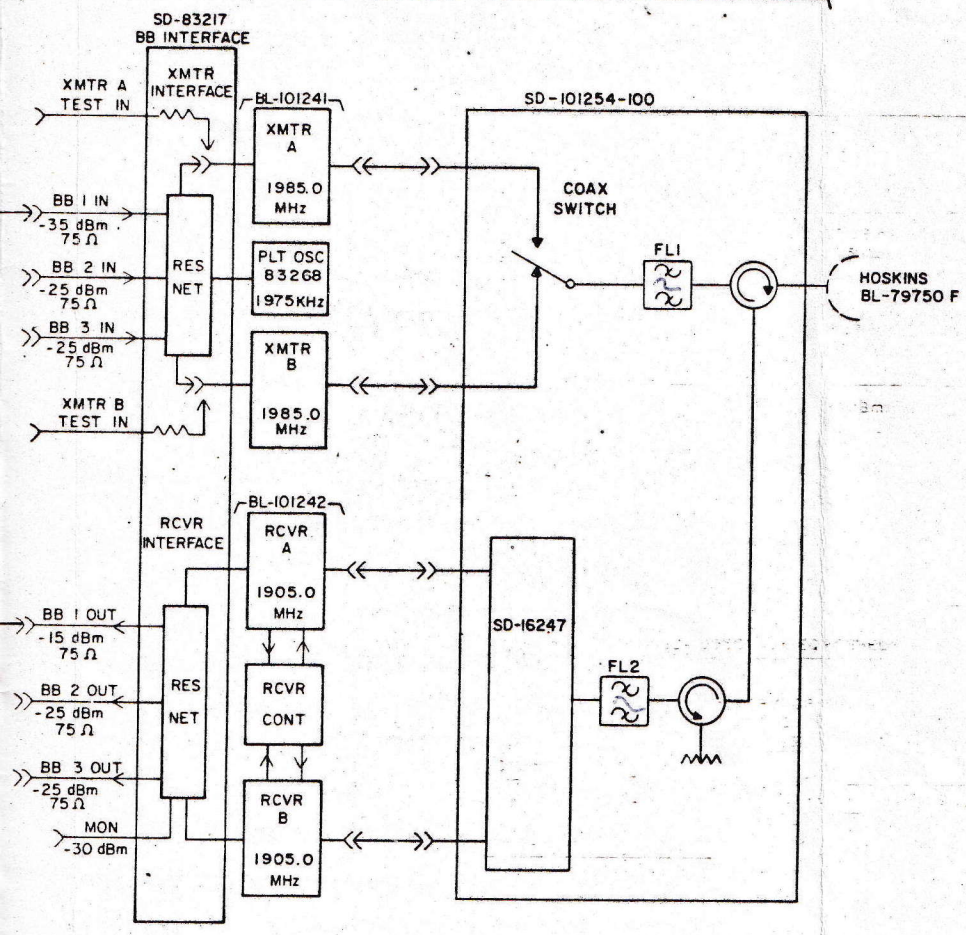

P/O 100557 TB
B
J4
-15 dBm 75Ω
A
J3
-35 dBm 75Ω
CONN TO ASS'Y PER FWL-79750 C1 (SHT 1)
D
J6
-15 dBm 75Ω
C
J5
-35 dBm 75Ω
50002 DANTEL 6W/4W BRIDGE 20dB ±0.5 300Hz/3.5 MHz
1
2
3
4
5
6
75Ω
75Ω
P/O 100557 SD-19797-006 PILOT STOP FLT
C
A
1796 KHz
0.1dB.IL.
P/O SD-19950 AUX EQPT SHELF
SD-19797-068
FL 2
POS 3
P/O 100557 TB
J2
75Ω
3C
3A
440 KHz
3B
4C
4A
408 KHz
POS4
-15 dBm 75Ω
SD-19797-068
FL 1
POS 1
75Ω
1C
1A
440 KHz
1B
J1
2C
2A
408 KHz
POS 2
HP, LP=0.1dB.IL.
-35 dBm 75Ω
P/O 19379 OW
J11
1
2
-35 dBm 75Ω
J11
5
6
-15 dBm (-13 dBm0) 75Ω

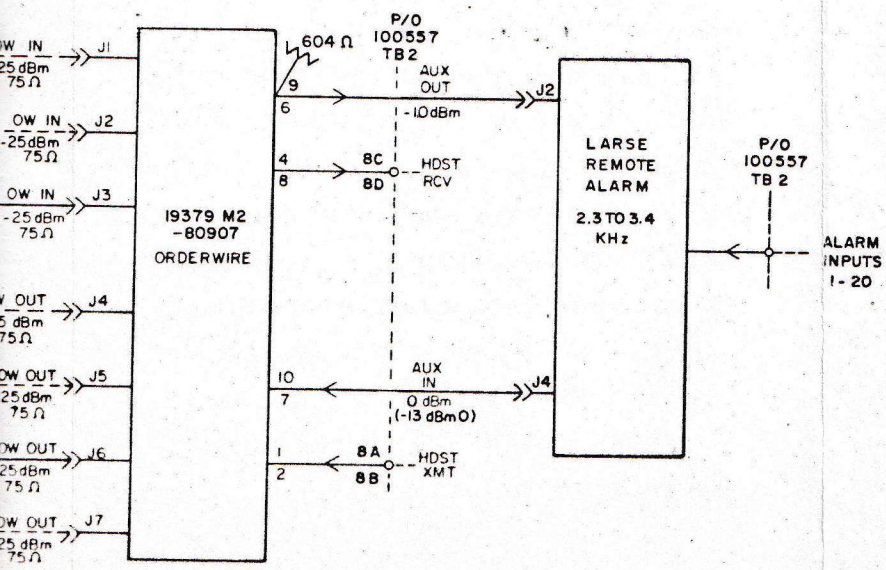
BL-79750 C

REVISIONS		
SYMBOL	APPROVED	DATE

L-79750 C 2

FL 1-2 BL-101270





CUSTOMER: NEB. PUBLIC POWER DIST.

LOCATION: EAST NORFOLK

SCALE	ENGR BY N G	APPROV	Y T T
DATE 4-21-80	DRAWN BY L I Z	APPROV	R K

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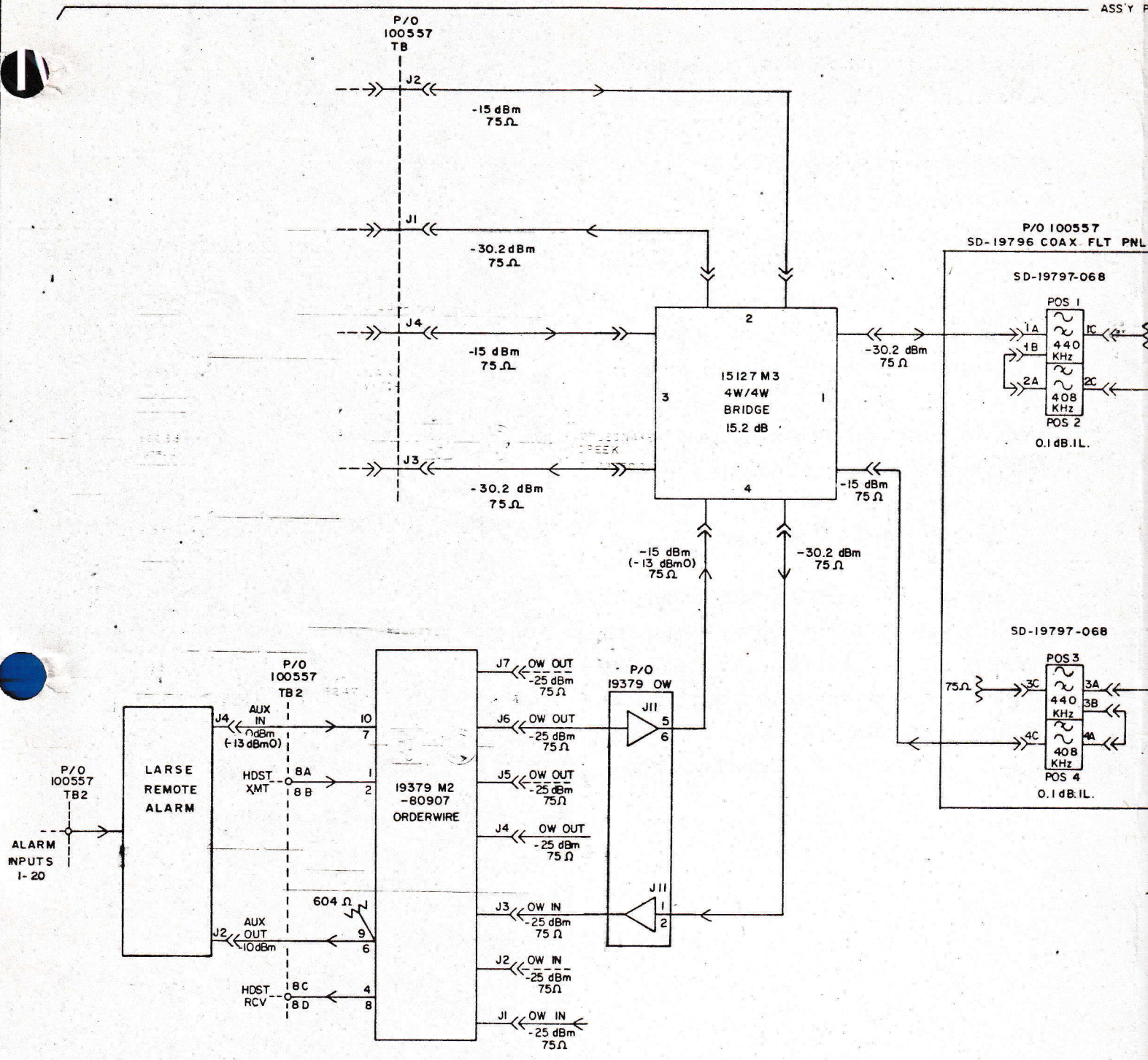
BLOCK & LEVEL DIAGRAM
FL1-2 MHS RADIO ASS'Y

DRWG SET	SHEET 2 OF 2 SHEETS	DRWG SIZE
BL-79750 C		D



2. _____INDICATES CUSTOMER WIRING OR CONNECTION.

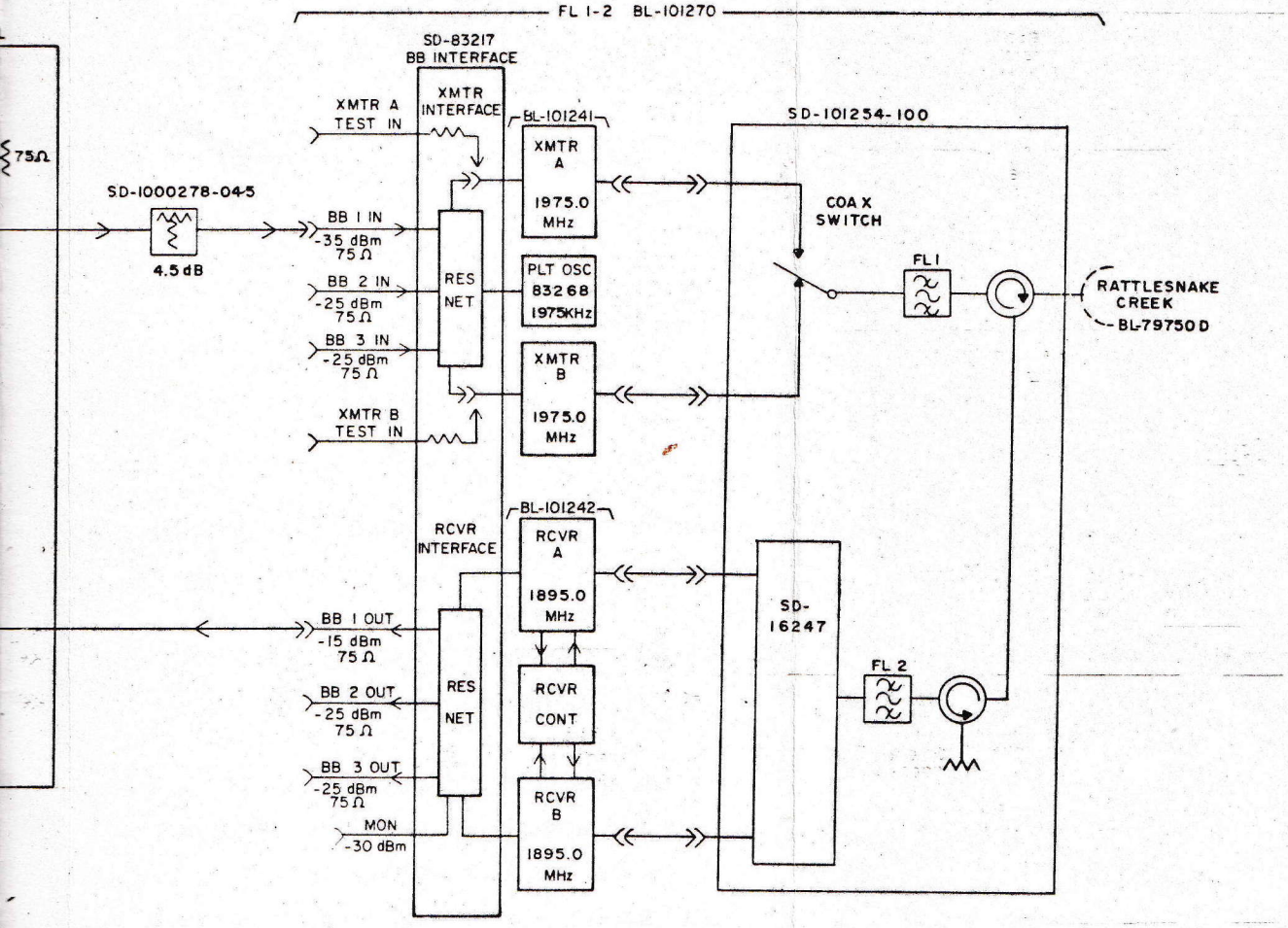
1. LEVELS SHOWN ARE NOMINAL TEST TONE LEVELS AND MAY VARY ±0.5 dB FROM THESE VALUES.

NOTES:

PER FWL-79750 E

BL-79750E

REVISIONS		
	APPROVED	DATE



CUSTOMER: NEB. PUBLIC POWER DIST.

LOCATION: JONES CREEK

		NG	YTT
DATE	4-18-80	DRAWN BY LIZ	RK

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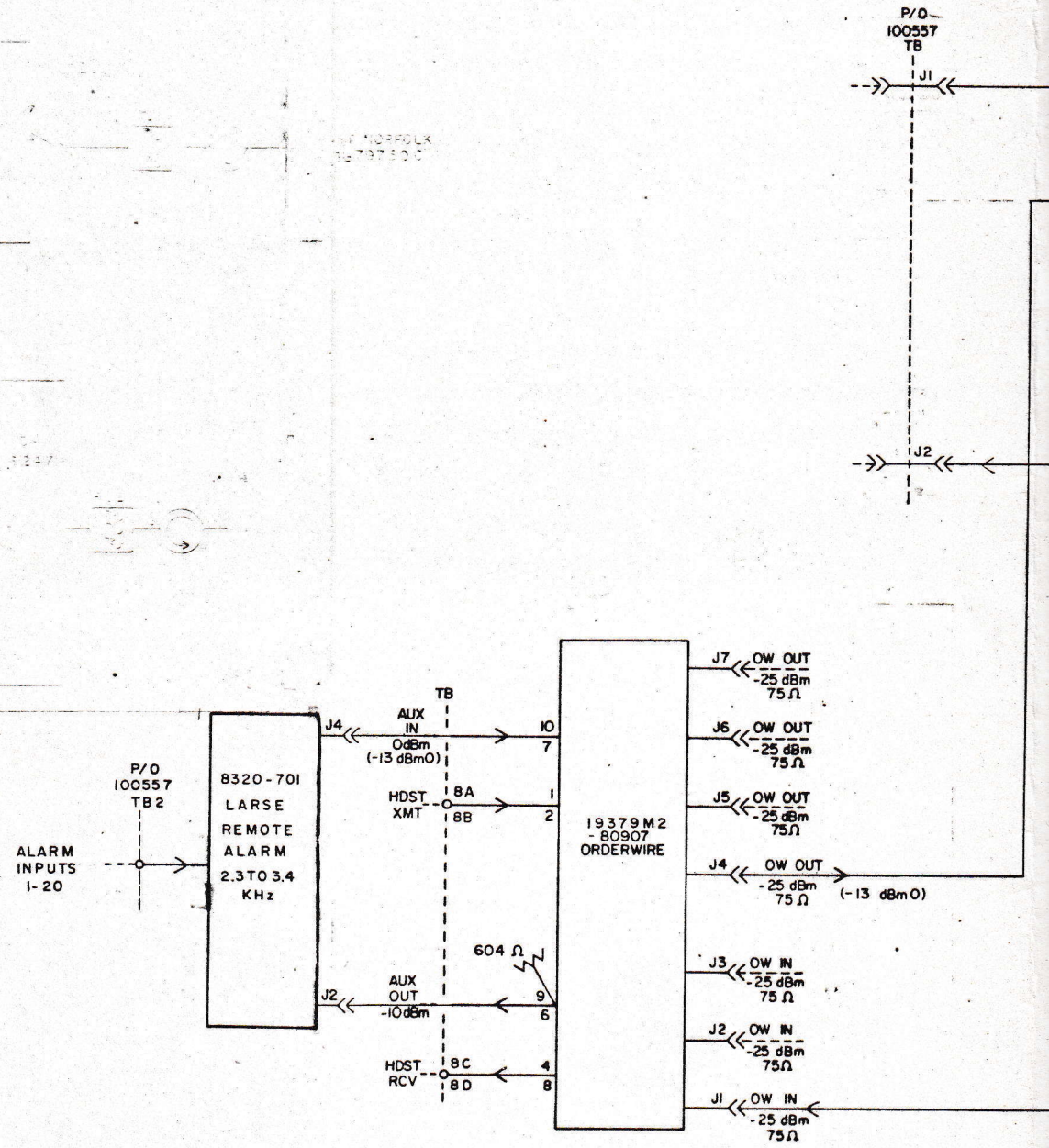
BLOCK & LEVEL DIAGRAM
FL1-2 MHS RADIO ASS'Y

SHEET 1 OF 1 SHEETS

BL-79750 E D



2. ____INDICATES CUSTOMER WIRING OR CONNECTION.

1. LEVELS SHOWN ARE NOMINAL TEST TONE LEVELS AND MAY VARY ±0.5 dB FROM THESE VALUES.

NOTES:

BL-79750F

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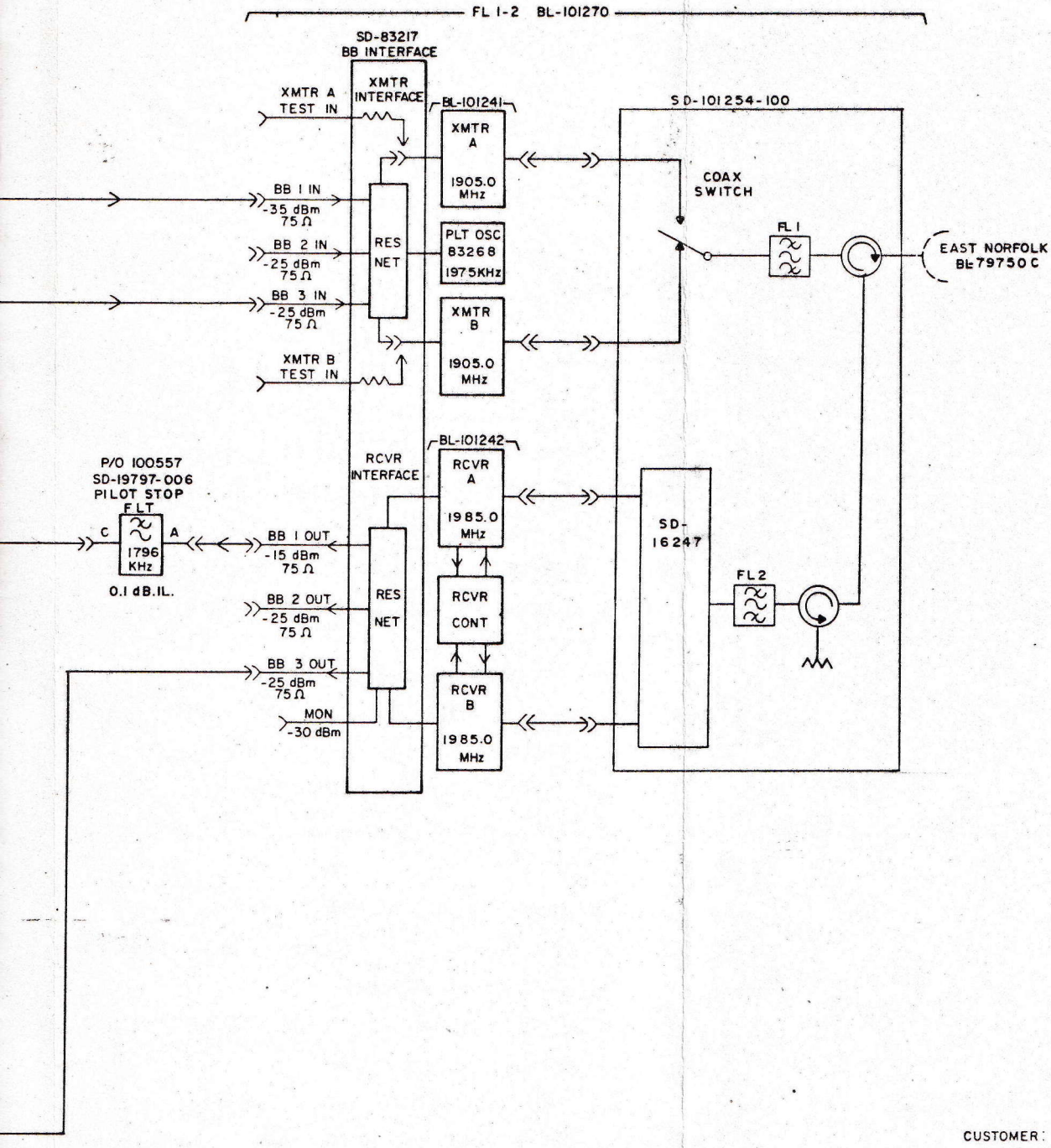
FWL-79750 F



CUSTOMER: NEB. PUBLIC POWER DIST

LOCATION: HOSKINS

SCALE	DRAWN BY NG	APPROVED	YTT
DATE 4-21-80	DRAWN BY LIZ	APPROVED	RK

Farinon

BLOCK & LEVEL DIAGRAM
FLI-2 MHS RADIO ASS'Y

CAGE NO.	SHEET 1 OF 1 SHEETS	DWG SIZE
	BL-79750 F	D